AGRICULTURAL CHEMICALS

In This Issue:

- Role of the Helicopter in Agriculture
- Bee Populations and the Newer Insecticides
- Alkyl Mercury Preparations as seed Disinfectants
- Taste and Odor Studies with BHC
- Chemical Weed Control in Small Fruits
- Rep. Hoeven on Fertilizer Trade and Private Enterprise

Vol. IV No. 8

AUGUST, 1949

. . . clear cut answers

to

insecticide problems

Have you sold DDT when you should have recommended Pyrethrum? Have you pushed Pyrethrum for a job that Chlordane should do? Yes . . . chances are you have been puzzled as to *what* insecticide to recommend for *what* insect, and under *what* conditions.

John Powell & Co., Inc., not only furnishes these insecticides and many more, but also can advise you as to their uses. As suppliers of a complete line of insecticide materials, Powell is free to give impartial recommendations . . . will suggest the right material for your problem.

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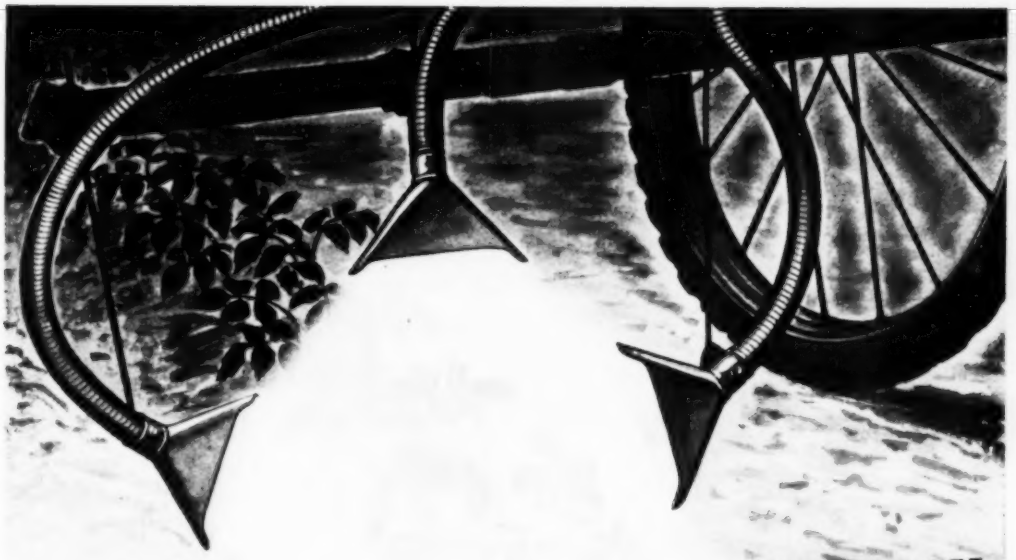

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AGRICULTURAL CHEMICALS

THIS MONTH'S COVER

Helicopter application of insecticides and herbicides is gaining in favor in agricultural pest control circles. Note downdraft placing fog throughout depth of trees to control Adirondack blackflies near Old Forge, N. Y. See article beginning on page 22. (Photo courtesy Bell Aircraft Corp., Buffalo, N. Y.)

AUGUST 1949
VOL. IV No. 8

A Monthly Magazine For the Trade

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Advertising Manager

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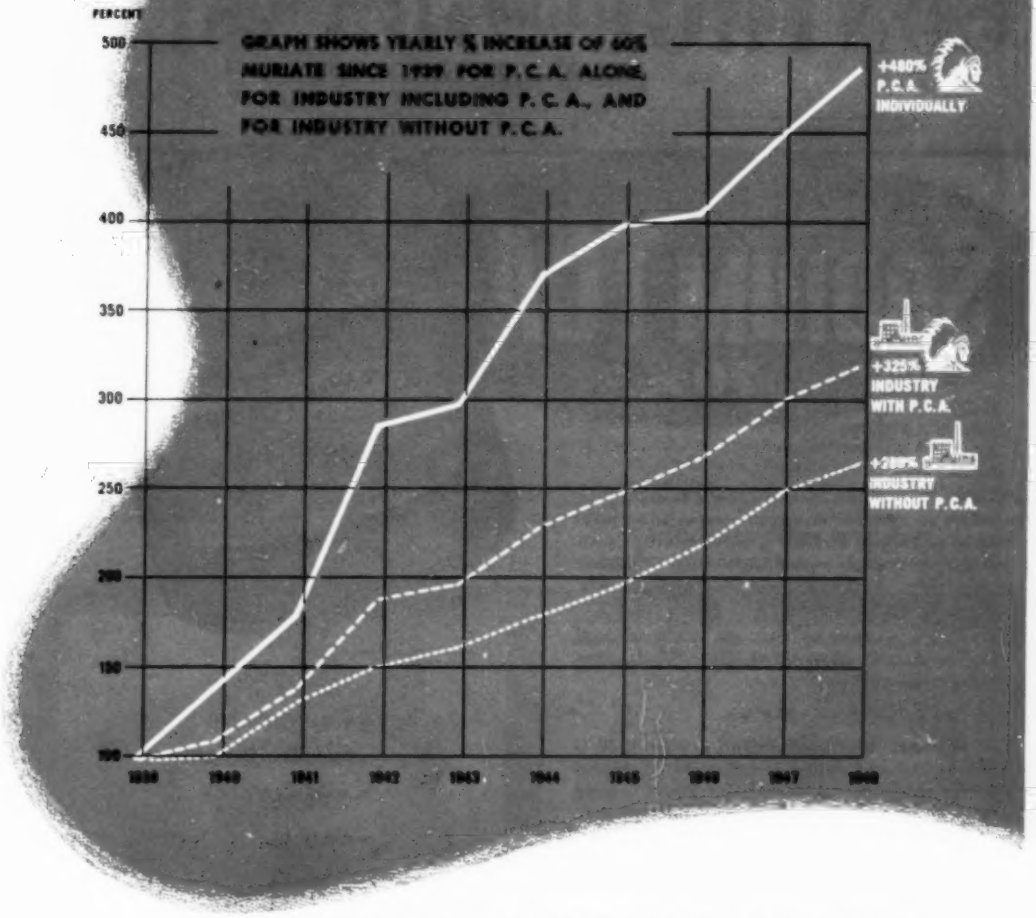

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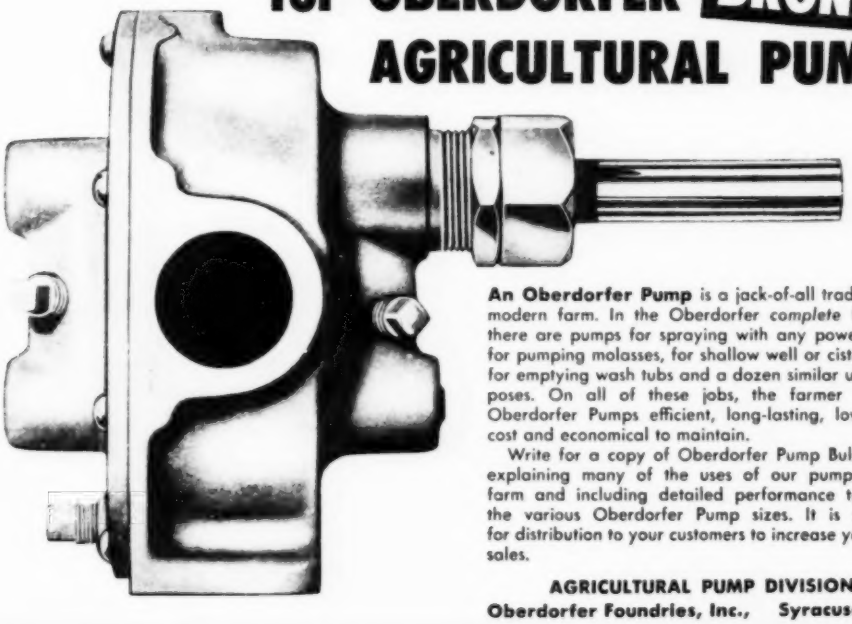

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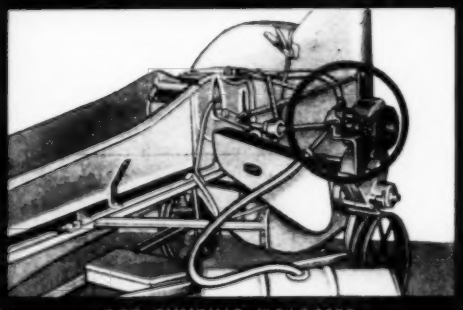
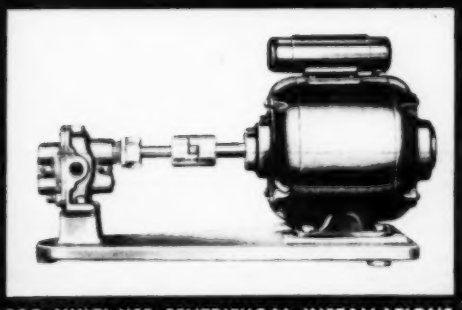
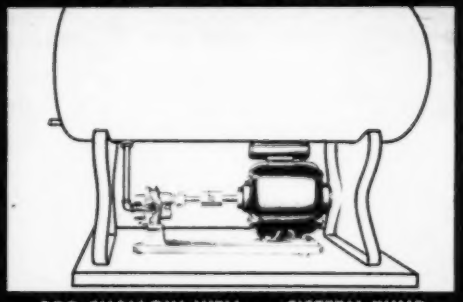


FOR PUMPING MOLASSES



FOR MULTI-USE CENTRIFUGAL INSTALLATIONS



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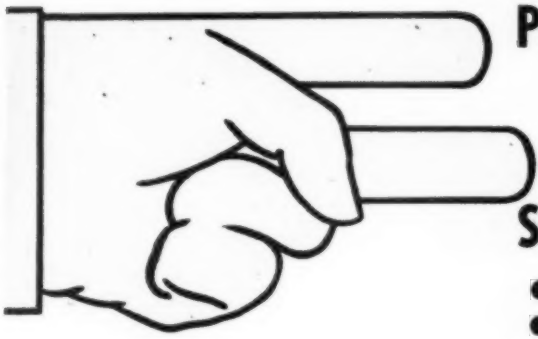

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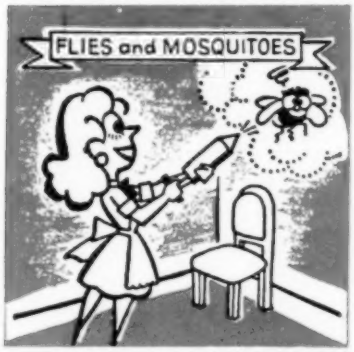

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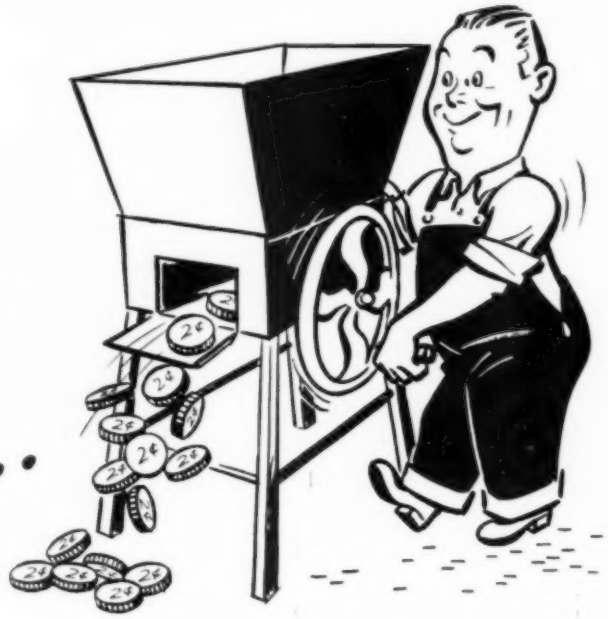

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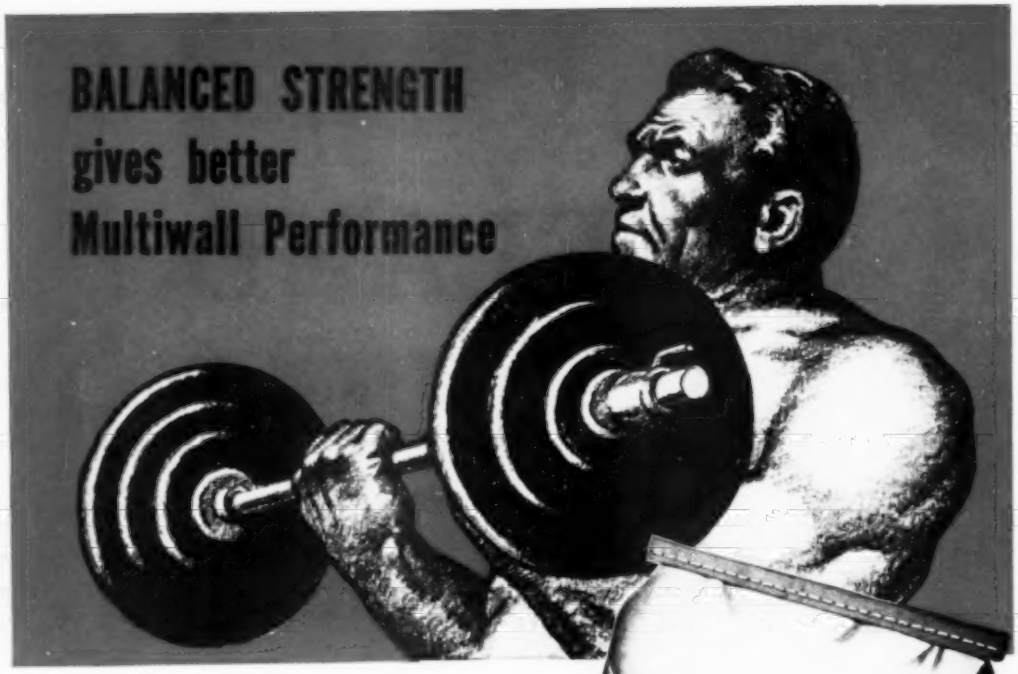

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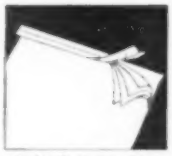

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THE EDITOR COMMENTS

SERIOUS spot shortages of insecticide materials loomed as we went to press. Unprecedented demands for toxaphene, BHC, chlordane and DDT have reduced stockpiles to an alarming extent, and from all appearances, the heavy demand may continue through the month of August!

The trade is quite familiar with the background which has contributed to this situation. The 1949 season has been an unusual one in that early last spring, when normal purchases should have been made, great uncertainty prevailed. Rumors were going the rounds that DDT and other materials would be "banned" from use . . . . . a public furore was launched with a number of ill-advised and badly-timed newspaper and magazine articles which frightened the public and put many of these useful toxicants on the defensive . . . some manufacturers of DDT halted production on the logical assumption that demand would be below normal this year. And, with record heavy infestations in major crop areas such as the cotton South and the corn belt, spot supplies of insecticidal materials were still diminishing rapidly at the end of July.

If there is a moral to all this, it could probably be summed up in another reminder that next year uncertainty must be cleared up early if manufacturers are to produce what is needed in time. Otherwise, it will be the same old scramble all over again!

WHERE would modern agriculture be today had the world not changed its attitude toward the scientist's search for truth? This question is brought to mind by a recent article "The Search for Truth," by Dr. F. E. Bear, appearing in *Better Crops With Plant Food*. Beginning with Copernicus, Dr. Bear reviews the rather amazing parade of subsequent scientists, most of whom added their contribution to knowledge in the face of militant superstition and ignorance. Just about all of these thinkers were banned from society, and at least one, Lavoisier, was beheaded because he presumed to doubt the prevailing "scientific facts" of his day.

Actually, it is only within the past few generations that scientists have been able to work openly in many parts of the world, and even now there are still those who tend to discount and discredit what science is doing. Not only should we be grateful to the scientific pioneers, but also to the numerous unheralded researchers of today who by their day-by-day investigations endeavor to find the answers to age-old questions about the control of insects, soil fertility, plant diseases and weed control. Only through their continued efforts can the world continue to feed its growing populations.

WITH regret we notice a statement on the June 15th issue of *Journal of Agricultural Research*, that "A shortage of operating funds has forced the discontinuance of this Journal. This is the final number." This Journal, published twice a month, was a veritable mine of information on agricultural research. Its progress reports on many phases of scientific tests were always a source of knowledge for the seeker who wished to know the trend of research and "what's new."

It seems a shame to many in the agricultural chemical field that the Government should become economy-wise and kill a useful publication like this; but the ways of bureaucracy are past finding out. We hope that some means may be discovered to re-establish the *Journal*, so that the flow of scientific information may not be impeded.

CHOICE of the word "Lindane" to designate the 99 percent pure gamma isomer of BHC appears to be most appropriate. It marks one more step towards the unification of nomenclature which has been sought so long. Immediate acceptance of the new name was apparent, judging from the way many manufacturers mailed out descriptive literature on the product. Although there is still a long way to go before a complete set of common names is established, "Lindane" marks important progress.

Role of the Helicopter in Applying 2,4-D and Pest Control Chemicals

THE helicopter, or rotory-wing aircraft, seems to have opened new fields for the application of chemicals and other material to weeds, crops and crop lands. In addition, it may possess improved means of application over other methods for some special conditions. However, there are involved certain economic disadvantages which tend to remove, at the present, at least, any implications that the helicopter is likely soon to displace the regular fixed-wing airplane in agriculture. Rather, it would be expected that the full development of special fields of usefullness peculiar only to rotory-wing aircraft would tax the production facilities of the helicopter industry for at least the immediate future.

Experience gained through helicopter spraying in California has been instrumental in assembling data helpful to many who produce, distribute, apply or use pest control chemicals. Most of the observations contained in this article, are based upon the experience of one season only, covering about 13,000 acres of 2,4-D spraying by helicopter. Verifiable scientific data are being planned for further helicopter work and may be reported at a later date. Plans include the use of helicopters for applying weed control materials on railroad and highway rights-of-way, further work on brush control to return land to grazing and general farming, control of weeds infesting range and forest areas, weed control in drainage canals and other waterways and expanded trials on cotton defoliation with liquid materials. There is need for scientific evaluation of helicopter performance in the selective 2,4-D spraying of corn, grain, rice and other crops with special emphasis upon drift studies.

An understanding of the chemical and physical properties of the various commercial forms of 2,4-D must necessarily underly any discussion of 2,4-D applications—and particularly considerations of drift and possible crop injury from drift. There must also be an understanding of the several field factors which influence 2,4-D behavior after it has been applied. This also involves a fundamental knowledge of the physiological and biochemical aspects of the weeds themselves and of the crops affected. Obviously, this is quite an assignment for the limited few who are capable of handling such a chore. Meanwhile 2,4-D is being used.

Below: Spraying 2,4-D on aquatic weeds in drainage canal. Right (page 23) Taking off from small landing spot on levee. Photo on 22 courtesy Helicopter Service of California; photo page 23 courtesy Bell Aircraft Corp., Buffalo.

by

Jack R. W. Wilson*

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There is always concern over the possibility of 2,4-D spray drifting to, or otherwise damaging, susceptible crops often far removed from the scene of spraying. The author has received many inquiries whether or not helicopters offer any solution to that problem. The answer is that the helicopter simply tends to minimize the escape of spray material beyond the spray area as much as seems possible by any aircraft. There is no appreciable backwash. The downdraft from the overhead rotor is in excess of one and a half million cubic feet of air per minute. This downward rush of air has been observed in trials during a dead calm, to recirculate within a relatively small spherical pattern. Helicopters utilize this downdraft of air, into which spray from the booms is injected, as a carrier of the material downward and into the vegetation being sprayed. A distinction should be made between the matter of spray drifting during the time of its application, and the matter of distant 2,4-D injury which may occur at some date after its application. However careful the application may be, by ground rig or from the air, the problems of 2,4-D injury to nearby or distant crops is not positively solved, in California

* The author has had wide experience in California with plants and chemicals during the past twenty years. He is one of the successful western pioneers in weed control and soil erosion work. The favorable results of his use of helicopters for weed control have focussed attention upon this method of spraying.

Double-rotor helicopter demonstrating dust application. Note how downwash pushes particles to ground. (Photo courtesy of Kaman Aircraft Co., Windsor Lock, Conn.)

at least, after the time of application. Warm weather and warm winds, together or separately, may volatilize most oils and certain forms of 2,4-D during or following their application to fields. This is particularly true if such sprayed areas are extensive. Warm air may accumulate and move masses of 2,4-D-laden air considerable distances into regions where susceptible crops are growing. Wind may also pick up and carry small particles of dried 2,4-D salts from sprayed foliage, or fine dry soil particles containing 2,4-D from sprayed fields, and transport it far from areas of its application. This is particularly true in regions of little or no summer rainfall, such as California.

In an effort to combat this potential wind movement of 2,4-D adhesive materials have in some cases been used along with the 2,4-D spray solutions to assist in sustaining the 2,4-D action upon the weeds and at the same time to safeguard partially against wind action on the 2,4-D after it is applied. This seems effective as far as concerns the 2,4-D on sprayed foliage, as no injury to adjoining or distant crops has occurred in more than 200,000 acres of commercial 2,4-D experience. Dependence is generally placed upon the vegetation obstructing any wind movement of excessive amounts of field soil particles which might carry 2,4-D from sprayed fields. Careful attention should be paid to the proper form of 2,4-D for the particular conditions involved.

Helicopter Pros and Cons

HERE is a summary of current observations on the advantages and the disadvantages of helicopter operations as viewed by 2,4-D spraying operations in California.

Advantages

Downwash of air overhead rotor—
- Tends to lessen drifting of spray material beyond spray area.
- Assists in delivering material downward where it is needed.
- Enables spray to reach small weeds even in tall or dense growths.
- Tends to circulate spray to underleaf as well as surface areas.
- Reduces losses of materials from dissipation in the air.

Helicopter Maneuverability—
- Makes possible operational flight in any direction, upward or downward, sideways, backward or forward, or hovering in mid-air at zero miles per hour.
- Saves time in turning at end of field.
- Allows precise following of rolling land at the predetermined height above crop or ground.
- Permits spraying right up to obstructions, and into and out of "tight" or irregular areas.
- Adds convenience of landings and take-offs from small spots such as roadsides, farmyard clearing or field corners.

General Advantages—
- Operator at all times has clear view of spraying area, especially directly below and in front of aircraft.
- Positive directional control even at slow speeds, assures accuracy.
- Requires no runway.
- Minimizes time lost in ferrying for refilling.
- Can operate remote distance from flying field.
- Selection of flying speeds from zero miles per hour to 70 miles per hour as may be desired.

Disadvantages
- High initial cost of helicopter.
- High cost of replacement parts.
- Limited number of skilled helicopter pilots and mechanics.
- Relatively small payload capacity.
- Restricted operational altitude with full payload.
- Meager public knowledge of helicopters.

Some fields of special usefulness for which the helicopter seems especially well adapted, should be pointed out as observed from the results of the limited experience reported in this article.

Certain northern California districts experience prolonged and cold winter seasons which are generally followed by warm, fast-growing periods. Grainfields in such districts spring into abundant growth under early summer sunshine. Under these conditions, late-germinating weeds such as Russian thistle (*Salsola Kali* L.) do not generally appear in proper growth stage for spraying until the grain

Helicopter hovering over orchard to direct flow of dust where it is most needed. (Photo courtesy of Bell Aircraft Corp., Buffalo, N. Y.)

is waist high. At such time the small weeds offer little total leaf surface to the spray and they are in addition difficult to reach close to the ground. For such conditions the helicopter does a near-perfect job of applying the spray downward into the heavy grain and upon the small weeds.

For the application of 2,4-D mixtures to aquatic weeds clogging the flow of water in winding canals and irregular waterways, the features peculiar only to the helicopter fit it ideally for effective control applications. By regulating the flying distance above the weeds and adjusting the forward speed of flight, almost any desired result may be obtained.

The helicopter's maneuverability, clear front downward visibility for the operator, slow operating speed and landing abilities make it well suited for spraying in flat or hilly brushland and range improvement programs. In San Mateo County approximately 50 acres of various stages of brush growths were sprayed by helicopter. Application of 2,4-D to small brush one and a half to two feet high gave perfect control. Brush four to six years old responded with about 85% kill. Application to old bush saddle-high and densely growing on grades to 25% grade showed approximately 60 to 65% control with one application. Helicopter downdraft was observed to drive the spray material in all the trial plots clear to the ground. Considerable more of this type of helicopter spraying is planned for the coming season, making the helicopter available for one of its most promising achievements.

In large sections of the Delta region of the Sacramento Valley Rough pigweed (*Amaranthus retroflexus* L.) grows in the sub-irrigated peat soil to unbelievable heights. Some plants of Rough pigweed have measured three inches across at the base and averaged about eight feet tall throughout a 500 acre field of potatoes on Rindge Island near Stockton. This weed can be cultivated out of crops like corn frequently between the rows, but weeds left in-row with the corn often grow taller than the corn. At harvest time the spikes which are six to ten inches in length hang over heavy with seed and interfere seriously with mechanical pickers. Then, too, in moist soils Rough pigweed sometimes emerges after the last cultivation when the corn is too tall to permit machine tools, and adds to the late weed problem. Control of that type of weed requires application not only from the air, but also a thorough distribution in relation to the total leaf and root area involved. For this kind of spraying the helicopter leaves little to be desired.

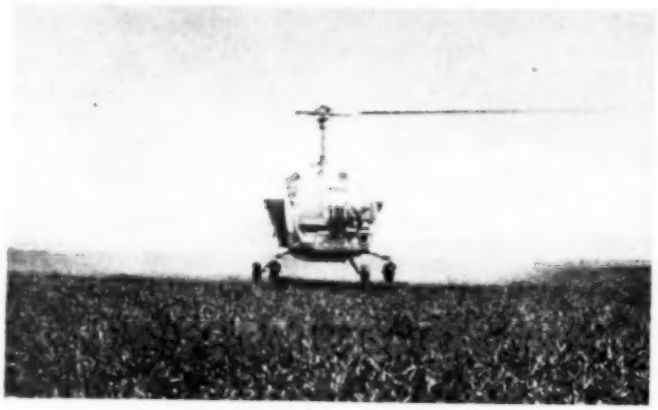
The helicopter was used to apply 2,4-D to approximately 60 acres of wild morning glory (*Convolvulus arvensis* L.) growing in dense clusters throughout the field of asparagus. Application was one and one half pounds of acid equivalent in sodium salt form per acre. This was applied in five gallons of water per acre. The asparagus was in the middle fern stage, plants were eight years old. The morning glory was in full bloom, some being heaviest beneath the fern. Some of the morning glory runners were in excess of two and a half feet and extended throughout many asparagus plants showing their blooms over the top of the planting. The helicopter did a particularly excellent job of reaching the weeds beneath the fern. At the end of nine weeks the control seemed to be about 80%. No permanent injury occurred to the asparagus.

Water is maintained in California ricefields mainly to compensate daytime and nighttime temperature differences. This practice poses a problem in getting 2,4-D materials onto the weeds in the

right manner and at the right time. Many California ricefield weeds are easily controlled by any means of spraying which is capable of reaching the weeds with the proper materials. Some of the more serious weeds, however, are difficult to control unless the material reaches the point of leaf or blade emergence. Some of the members of the Cyperaceae family must have portions of their growths sufficiently above water at time of application to permit 2,4-D to reach such blade separations. Frequently other vegetation interferes with the easy application to such weeds. Control of this weed by helicopter, using five gallons of spray per acre, has been fully satisfactory.

Mention might be made that results on one twenty acre cotton defoliation plot on the Yettum Road, near Visalia, in the San Joaquin Valley, showed that the helicopter is able to apply liquid defoliant materials upon the basal leaves even in dense cotton four to five feet high, even when the foliage is grown together between the rows.

From the commercial weed control in rice and grain, and the limited amount of other weed control work by helicopter as is briefly noted here, it seems that agriculture has another good tool with which to wage battle against its many unwanted pests.



In The Photos

Above, right: Kaman double-rotor helicopter illustrates uniform downwash as it dusts field. (Photo by Kaman Aircraft Co., Windsor Locks, Conn.)

Right, center: Spraying 2,4-D on water hyacinths on winding drainage canal. Moving slowly, helicopter is able to follow exact contour of stream. (Photo by Jack Wilson Chemical Co.)

Right, lower photo: Helicopter spraying toxaphene for control of grasshoppers. Flying speed, 35 m.p.h. (Photo by Jack Wilson Chemical Co.)

The Effect of Field Applications of Insecticides on Honey Bees[1]

by

Frank E. Todd, F. V. Lieberman, W. P. Nye and G. F. Knowlton

U. S. Department of Agriculture (Todd, Lieberman and Nye) and Utah Agricultural Experiment Station (Knowlton)

REPORTS of tests of new insecticides have tended to minimize the practical dangers to beekeeping when these toxicants are applied to crops in bloom. The idea is current that these insecticides are harmless to bees if applied during hours when bees are not on the field. An examination of one alfalfa-seed area, where bee losses from commercial applications were reported, prompted a more critical examination to determine the effect of field applications of these insecticides on bees. This paper is a report of field experiments near Logan, Utah, with early-morning applications of DDT, chlordane, parathion, and toxaphene to alfalfa in flower.

Many workers have performed cage experiments against honey bees with DDT, chlordane and parathion. All are in agreement that these materials are lethal to bees as stomach and contact poisons. Butler and Shaw (1948) reported one test with toxaphene spray and classed it as "relatively nontoxic."

Only a few field tests have been reported. Linsley and MacSwain (1947) pointed out that large-scale mortality has not been demonstrated, but that in their experiments, caged bees that had been collected from DDT-dusted fields showed a high death rate in 24 hours. Eide (1947) concluded from miscellaneous field observations that 5 per cent DDT dust is less toxic than calcium arsenate or cryolite. Hammer and Karmo (1947) concluded that DDT is not dangerous to bees unless it is applied to plants in bloom. Way and Synge (1948) concluded that commercial applications of DDT to open blossoms are harmless to bees. Piettre (1947) found normal colony behavior and an increase in brood surface in colonies located in DDT-treated orchards.

McGregor and Vorhies (1947) performed extensive tests with DDT on cotton, finding that several airplane dustings of bees confined in cages caused complete mortality in seven hours. Less severely exposed bees recovered after showing nervous symptoms for one hour. Field applications of 5 per cent DDT dust at 20 pounds per acre affected a few bees and weakened the colonies temporarily, although it did not permanently injure the colonies. The authors concluded that large-scale dusting of DDT to cotton is not hazardous to commercial beekeeping.

Hinman and Cowan (1947) observed no poisoning or weakening of colonies moved onto an alfalfa field the evening it was sprayed with chlordane.

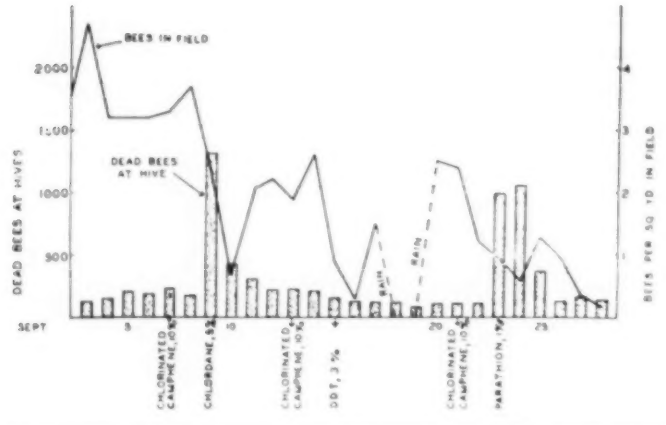
In general, investigators have concluded that, while these new insecticides are lethal to bees, field applications have caused minor or no losses. The opinion of beekeepers in certain areas is contrary to this view. They attribute poor honey crops and depleted field forces to DDT dustings, although they have not found large numbers of dead bees.

Experimental Procedure

ON September 1, 1948, eleven colonies of bees were placed approximately 30 feet from 2 acres of blooming alfalfa. The September dearth of honey plants assured their visitation to this alfalfa. The short distance from the field to the hives lessened the chance of losing affected bees along the line of flight. Surveys disclosed that a Ladino clover pasture nearby was the only other field attracting appreciable numbers of bees. The

[1] Cooperative investigations of the Bureau of Entomology and Plant Quarantine, the Bureau of Plant Industry, Soils, and Agricultural Engineering, and the Utah Agricultural Experiment Station.

FIGURE 1. DEPRESSION OF HONEY BEE VISITATION ON ALFALFA AND TOTAL PICKUP OF DEAD BEES AT HIVES, AS RELATED TO EXPERIMENTAL APPLICATION OF INSECTICIDES. CACHE VALLEY, UTAH. 1948.



closest apiary was approximately 3 miles away.

Various insecticides were applied in the sequence and at the dosages given in table 1. At each application the entire acreage in bloom was dusted with a power duster. All applications were made between 7 and 7:45 a.m., when at this season bees had not left the hives. The interval between applications was 48 hours, or a time sufficient for the visiting field force to return to normal volume and activity, whichever period was longer. The per cent mortality in table 1 is based on bee visitors to the treated field, not on the colony populations nor their total force.

With the exception of a two-day rainy period, which began three days after the treatment with DDT, the weather was clear and without strong winds. The daily maximum temperatures ranged from 70 to 92 F. before the storm and from 67 to 75 afterwards. These temperatures allowed for at least six hours of good flight by the bees each day. There was a progressive decline in visitation of bees to the field associated with gradual reduction in the amount of bloom.

The 0.34 inch of rain during the two days washed off most of the dust that had accumulated from the first four applications. The fact that the mortality was low each time toxaphene was applied, indicated that the accumulation did not obscure the results of any one test.

Measurement of Results

THE number of bees exposed to a treatment was estimated by counting those observed on 50 or more square yards between 1:30 and 2 p.m. each day, according to the method described by Vansell and Todd (1946).

Mortality was estimated by collecting dead bees at the hives and in the field. The daily pickup at the hives was made from 8:30 to 9 a.m. on an area extending 10 feet forward from the rear of the hives. The normal number of dead bees was established by making counts for several days before the first dust application. The mean of these counts, 150, was thereafter deducted from each daily pickup. Beginning at 4 p.m. on the first and second days after each dusting dead bees were picked up on several strips 1 foot wide extending across the field. Only bees that appeared to be freshly dead were included in the count.

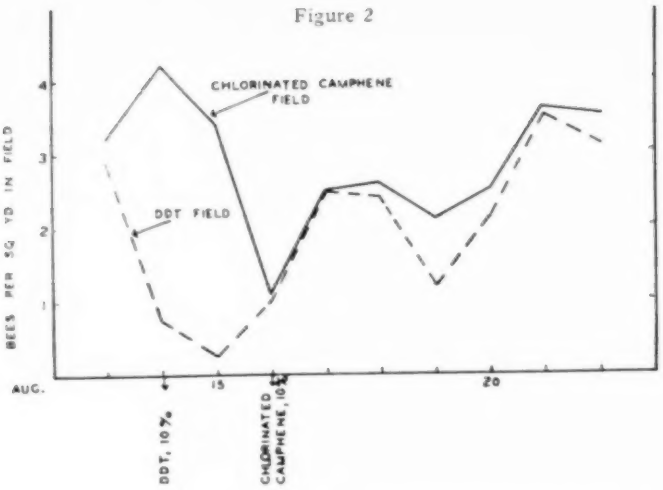
TABLE 1

Effect on honey bees of insecticides applied as dusts under various conditions to 2 acres of flowering alfalfa, Logan, Utah, 1948

Date	Insecticide	Dosage (Pounds per Acre)	Temperature (F.) Range During First 48 Hours	Dew at Time of Treatment	Number of Bees Exposed	Number of Bees Killed		Per Cent Mortality
						At Hive	In Field	
September	Chlorinated							
7	camphene 10%	17	35–70	Moderate	29,040	86	[1]	
9	Chlordane 5%	22	37–82	Heavy	21,295	1779	3049 (92)	23
13	Chlorinated							
	camphene 10%	19	41–87	Moderate	19,360	149	1471 (46)	8
15	DDT 3%	30	47–92	None	8,228	65	2236 (69)	28
21	Chlorinated			Very				
	camphene 10%	28	46–75	heavy	23,232	77	523 (92)	2
23	Parathion 1%	23	34–69	None	7,357	1969	1007 (115)	40

[1] Numbers in parentheses indicate square yards covered in sampling.

Figure 2



It is recognized that not all dead bees are recovered by these methods. Some bees affected in the field strayed to other acreage, others dying at the hive were carried beyond the examination area by the house cleaners, and doubtless scavengers removed specimens from the field and at the hive.

Results Death of bees after the various dustings apparently was confined to the field force, with a possible exception in the case of parathion. The second morning after the parathion application a conspicuous number of bees were crawling around the hives. The fact that their number exceeded the dead of the previous morning suggested a possible mortality among the house bees. This feature was not investigated.

In this experiment, toxaphene was much less lethal to bees than was parathion, chlordane, or DDT (table 1). Of the four insecticides used, parathion was the most destructive to bees. In two previous field tests, not reported here, toxaphene caused no conspicuous damage to colonies.

The place where the bees died, varied with the insecticide used. After the parathion application, two-thirds of the dead bees were found about the hives. About two-thirds of the deaths from chlordane and most of the mortality from toxaphene and DDT occurred in the field. It is possible that failure to search for dead bees in the field may largely account for previous conclusions regarding the hazards of DDT to beekeeping. However, heavy concentrations of dead bees are not to be expected when live bees in alfalfa fields seldom exceed three per square yard.

That the death of bees caused by chlordane or parathion occurred largely during the two days after application is shown in figure 1. The danger period from DDT is probably about the same. Figure 1 shows also a depression in the number of bees visiting the field after the application of chlordane, parathion, or DDT. In the case of chlordane and parathion this decrease is largely accounted for by the death of bees.

Bees react quite differently to DDT than to chlordane, parathion, or toxaphene. DDT dust is a slow repellent. After about one-half hour in the DDT-dusted field the bees began to rub their hind legs together as do pollen collectors, clean themselves, and stopped collecting from the alfalfa. Many bees, stupefied or cleaning themselves, were clinging to vegetation or other objects about the fields, but were capable of flying when disturbed. About 95 per cent of the bees observed during the field counts showed symptoms of DDT poisoning. Many of them were not recovered among the dead bees and are presumed to have survived contact with DDT. By depressing visitation the repellency of DDT limits mortality to bees that persist in their collecting. Our observations indicate that the repellency factor is more effective during a period of abundance than during a dearth of honey plants.

Daily counts of bees visiting a 7-acre alfalfa field dusted with 10 per cent DDT and a nearby 6-acre field treated with 10 per cent toxaphene are shown in figure 2. Both insecticides were applied when bees were not on the field. The characteristic depression in numbers of visitors to the DDT-treated field continued for two days, after which the population followed a trend similar to that on the field dusted with toxaphene. The depression on the day that toxaphene was applied is attributed to a strong wind rather than to the insecticide.

Discussion

THE number of bees killed by the dusting of 2 acres of alfalfa may appear to be of minor importance. The amount of damage done to an apiary would depend largely upon the time of the dusting in relation to a honey flow and upon the proportion of the bee range treated. The killing of appreciable numbers of field bees during a honey flow would reduce the amount of nectar gathered. The field bees of an apiary may be spread over the 5,000 acres within effective flight range, or they may be concentrated on a few attractive fields. Dusting, during a honey flow, of a large portion of the plants being visited by the field force of an apiary could, apparently, bring about a marked reduction in the honey crop.

(Turn to page 77)

The Role of Alkyl Mercury as a

FUNGICIDE

THE development and use of the alkyl mercury compounds for treating crop seeds to protect and make them free from disease is one of the great accomplishments of modern agricultural science. It should take its place alongside hybrid corn, the new herbicides and DDT. It has contributed materially in making possible the record-breaking crops of recent years.

It will be well at this time to indicate the serious nature of plant disease, in order to point out the significance of materials to control it. A recent tabulation of the economic plant diseases known to occur in the United States has been under way for some time at the U. S. Department of Agriculture's Plant Industry Station at Beltsville, Md. Approximately 50,000 separate diseases of economic plants are listed. On corn alone, there are 114 different troubles. On potatoes there are 127; on wheat 88; and on cotton, there are 80 different maladies mentioned.

Several years ago the annual loss from plant diseases in the United States was estimated at 1½ billion dollars and this is now regarded as being very conservative. Now, with a much greater production and a price index higher than it was then, and making allowances for progress in disease control, perhaps the loss would approach more nearly 2 billion dollars if estimated today.

Of the 50,000 plant diseases, it is definitely known that at least 500 are borne on the seed. They are caused by fungi, bacteria, or viruses. Transportation is provided by the seed on, in or with which they are disseminated over long distances. These viruses are the culprits about which the most concern is felt at the present moment because it is in the fight against them that the organic mercurials have been so useful.

Among some of the more important seed-borne diseases, against which seed treatment is used as a weapon, are the smuts of wheat, oats, barley, and sorghum; stripe and several other leaf diseases of barley; scab of small grains, Helminthosporium blight of oats, anthracnose and angular leaf spot of cotton; scab, Rhizoctonia, and ring rot of potatoes; several leaf diseases of cucumbers, tomatoes, and crops of the cabbage family; and a large number of seed rots and seedling blights of such crops as corn, flax, peanuts, cotton, small grains, sugar beets, and many vegetables and ornamentals.

Historical Background

THE practice of seed treatment goes back many years. It is said that early explorers in Africa found the natives tossing their kafir-corn seed through a fire, and this undoubtedly resulted in a certain degree of surface sterilization and reduced the amount of smut in their crops.

In Great Britain the practice of brining or pickling wheat, that is, soaking in salt water, seems to date back to about 1670, when it was discovered that wheat seed salvaged from the sea resulted in crops comparatively free from smut or bunt.

Soaking wheat seed in lye and then sprinkling with lime was another early treatment found to reduce the amount of smut. It was recommended in France as early as 1755 by the French investigator Tillet who definitely proved that stinking smut of wheat was seed-borne.

Some 60 years later, soaking wheat seed in a solution of copper sulphate was found by a Swiss botanist to be much more effective than anything that had been tried before, and this bluestone dip became the standard treatment in Europe and the United States for many years. In fact, it is being used to a slight extent in a few isolated localities in the United States even today.

Formaldehyde was developed as a seed treatment about the close of the last century and largely took the place of bluestone with small grain. Both bluestone and formaldehyde were *wet* treatments and were subject to the various objections that came from wetting seed. Furthermore, they sometimes injured seed rather severely under certain conditions.

Therefore, the advent of the dry copper carbonate dust treatment, adopted from Australia about

by

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1922, was welcomed because here was a dry powder that could be mixed easily with the seed, was non-injurious to it, and was effective against bunt. However, this also had certain objections in that it did not work on small grains with hulls like oats and barley and it sometimes caused sickness of operators who breathed the dust. Mechanical troubles also were caused by the chemical interfering with drilling the treated seed.

This brings the story up to the 1930's when the results of research on organic mercury compounds entered the picture. The development of the alkyl mercuries, especially ethyl mercury chloride and ethyl mercury phosphate, inaugurated a new era. Here, at last, were some greatly improved chemicals. They could be used in *dry* form in very small amounts. They were highly toxic to fungi and bacteria, and at proper dosages could be applied safely to seeds. It became possible to make easier and speed up the operation of treatment. Costs were lowered. Treated seed could be stored safely without decreasing germination and with some degree of protection against insects and rodents. Furthermore, these fungicides were *volatile*, which means that a less thorough job of mixing could be permitted and also that disinfection of a zone of soil in the immediate vicinity of the treated seed became possible. This last attribute was something new and opened the way for an attack on soil-borne organisms responsible for seed decays, seedling blights, and damping off. It gradually became evident that, with many seeds, treatment for this one purpose alone, namely, seed and seedling protection, was of much benefit. Especially was this true with mechanically injured seed, or with seed of low viability, or with seed exposed to an unfavorable environment. The idea of seed protectants took hold, and the organic mercuries proved to be excellent protectants as well as disinfectants. Among these were ethyl mercury chloride, ethyl mercury phosphate, and more recently developed ethyl mercury p-toluene sulfonanilide in the United States, and phenyl mercury urea in Canada. Some of these showed possibilities as sprays for application to plant foliage. There have been developed also phenyl mercury triethanolammonium lactate and more recently phenyl mercury acetate, fungicides that appear very promising.

During the early years of introduction of these new seed-treating chemicals a great deal of experimenting and testing took place on the part of the United States Department of Agriculture and the State agricultural colleges and experiment stations. The American Phytopathological Society organized and conducted uniform, nation-wide seed-treating experiments. The State extension services, through their specialists, information offices, and county agents carried the message to the farmer by means of demonstration, word of mouth, and the printed page.

Benefits from Treatment

IT is difficult to get any reliable figures as to the extent to which seed treatment with these chemicals has been accepted. Most of the available data are fragmentary and have to do largely with *cereal* seeds. However, here are a few significant examples.

An elevator company located in a midwest grain state recently published a statement demonstrating the results of its program of treating seed for farmers in its trade territory. The story unfolded in this brief statement showed that by the use of 4 840 pounds of "Ceresan"** seed disinfectant the grain firm had brought more than $332,000 extra money into its community. Here is the record contained in the firm's statement. There were treated with this material at an average rate of 1 pound to 22 bushels of seed, some 70,620 bushels of oats, 3,608 bushels of wheat, 11,016 bushels of barley, and 20,434 bushels of flax. In other words a total of 105,688 bushels of seed grain and flaxseed were treated. This seed was sown on 59,058 acres and produced a harvest of 2,355,249 bushels—a yield increase of 198,803 bushels. Figuring the oats at $1.16, wheat, at $2.98, barley at $2.60, and flax at $3.80 the increase in yield brought $ 32,425.44 extra money into the pockets of local farmers for the 1947 year.

This seed-treating operation was of benefit to everyone. The farmers got increased yields of smut-free grain. The elevator made a profit on the treatment and received better quality grain in larger volume.

These new seed-treating chemicals and machines for applying them have created new and growing businesses for elevators, seed houses, and operators of portable seed cleaning and treating equipment. A large New York State cooperative treated some ½ million bushels of oats for its customers last year. Minnesota has about 200 such custom treating services in operation. In Indiana and Illinois, over 200 portable combination seed cleaners and treaters travel annually from farm to farm conditioning thousands of bushels of wheat, oats, and barley.

* Paper presented before the Delaware Section of the American Chemical Society, Wilmington, Del., Jan. 26, 1949, on the occasion of presenting of the John Scott award to Dr. Morris S. Kharasch for his work in the field of alkyl mercurials.

** Trade mark registered by E. I. DuPont de Nemours & Co., Inc., Wilmington, Del.

One of the large grain companies in the spring wheat area has made surveys each year for the past 5 years through its line elevator managers to find out how much of the small-grain acreage was sown with seed treated with ethyl mercury phosphate. From its 1948 survey, the company reached the conclusion that 62 percent of the wheat, oats, barley, and rye acreage in three States, Minnesota, North Dakota, and South Dakota, was sown with treated seed.

If we assume losses from chemically controllable seedborne diseases of 3 percent for wheat, 4 percent for oats and barley, and 1 percent for rye in fields sown with untreated seed, the benefit from seed treatment would amount to some 4 million bushels of wheat, nearly 9 million bushels of oats, about 3¼ million bushels of barley, and 82,000 bushels of rye. Loaded into cars this quantity of grain would make up a train 65 miles long. At the current Government support price for these grains at Minneapolis this quantity of grain would be worth $19,315,000. If we add to this the savings from marketing clean rather than smutty wheat, the figure will be about 20 million dollars. This figure represents the increased returns to farmers in these three States (Minnesota, North Dakota, and South Dakota) for these four small grain crops only.

Take another State, Kansas, the center of America's great breadbasket. In 1947 the extension plant pathologist in Kansas estimated that seed treatment saved for farmers in his State, 5 million bushels of wheat, 7½ million bushels of oats, 5¾ million bushels of grain sorghum, and 370,000 bushels of barley. At prevailing farm prices this would have been worth nearly 28 million dollars.

Similar figures for Colorado show a saving of $4,200,000. Some of the new, high-yielding, rust-resistant oats, which were widely planted in a recent season, proved to be extremely susceptible to a new Helminthosporium blight and many fields were ruined. It was shown that seed treatment was helpful in control, so in the following spring there was intense interest in seed treatment. Under the barrage of the campaign, local stocks of seed disinfectant disappeared quickly and new supplies had to be rushed to the front. Results of the campaign in Pennsylvania are typical of what happened in some of the other states. In Pennsylvania, yield comparisons of Vieland oats in 5 counties showed that the untreated seed yielded 20 bushels, while the treated yielded 27½ bushels per acre—an increase of 7½ bushels, or 37 percent. This meant that 324,000 acres of treated Vieland oats yielded 2,300,000 more bushels than would have been harvested without treatment.

The growth in the use of hybrid corn in the U.S. has been almost phenomenal. Starting from virtually scratch in 1932 it has become so widely adopted that today 75 percent of the total corn planted consists of the hybrid strains. In the interest of seed protection and more satisfied customers, almost all hybrid seed corn is treated before sale. Before the recent introduction of other products, ethyl mercury phosphate was used on 50 to 75 percent of seed for this purpose.

In the case of cottonseed, increases in yield ranging from 10 to 15 percent are common, and increases of 40 percent are not infrequent. Treatment of cottonseed reduces seed decay and seedling blight, improves stands and thus avoids the necessity of replanting. Better yields of seed and lint are given. The practice has developed tremendously since 1935. In some States east of the Mississippi it is thought that as high as 60 percent of the planting seed is treated each year. For the United States as a whole perhaps about 30 percent is treated, mostly with the organic mercurials. With a 1948 acreage of 23,000,000 acres this would mean 6,900,000 acres treated. If these treated acres yielded even 20 pounds of lint more than the untreated, it would represent an increased production of 276,000 bales of lint and 111,504 tons of seed.

Flaxseed was in great demand during the war and since; and in 1948 nearly 5 million acres were grown. One of the troubles in growing flax is thin stands with resulting weedy crops. Flaxseed is likely to be injured or split in threshing. It often has tiny cracks in the seed coats through which seedrotting fungi can enter. The mercurial at the rate of 1½ ounces per bushel protects such seed, results in more perfect stands of plants, and gives weeds less opportunity to grow.

In the case of sugar beets, damping-off of seedlings is the chief obstacle in obtaining a good stand. Very definite improvement in stands can often be obtained with organic mercury and other seed treatments coupled with adequate fertilization and crop rotation.

Summary

In concluding this summary of the benefits from the alkyl mercurials, the satisfaction that comes to the grower from producing a clean, high quality crop must not be forgotten. The increased income to the farmer because of higher yields of better quality has been mentioned; also the added compensation for the man who does the treating; and the benefit to the buyer from larger volume of better quality products. Also mentioned are the increased business for the manufacturers of the chemicals and seed-treating machines. To these should be added the protection and insurance that accrue to the grower, by reason of seed treatment, the reduction of hazard and worry in bringing the fruit of his field to a successful harvest, and the personal satisfaction and pride that come to him from having grown a good crop.

Government vs Private Enterprise in the

Fertilizer Industry

Congressman urges fertilizer industry to demonstrate that free enterprise system can surpass Gov't operation in furnishing fertilizer better, cheaper, more promptly.

LIBERTY is a cherished word among our peace-loving people. Where liberty prevails, a free enterprise economy is usually to be found. Many encroachments are being made on the field of private enterprise today in many parts of the earth. There are those who contend that the world-wide trend towards socialism will soon engulf America also and that there is very little we can do about it.

The American farm is said to represent the last stronghold of the competitive free enterprise system as it has always been known in this country. The farmer is still a man who likes to run his own business without unnecessary interference from Washington. He is a sound thinker and full of common sense. He is tax conscious and likes to have value received for his dollar. He is alert to domestic and world conditions and is usually better informed than most people realize. Almost daily his attention is called to various appealing and Utopian plans for the welfare of agriculture, but he regards them somewhat with suspicion. If the American farmer is to continue as the champion of our private enterprise system, we must make that system work before his very eyes. Nothing may be taken for granted.

The essence of the issue then, is government vs. private enterprise. Applying this issue to the field of commercial fertilizer, the plant food industry itself must continue to show that our free enterprise system really works. It must also continue with its research in the development of new ideas and the improvement of its product. It must convince its customers, the farmers, that it is doing better than the government could do in getting better fertilizer for the farmers, when they need it, and at a lower cost.

Most Americans are not in favor of putting the Federal Government in business in time of peace. So the average taxpayer, including the farmer, does not like to use the taxpayers' money to finance the construction, maintenance, and operation of fertilizer manufacturing plants when private industry is willing and anxious to increase the production of essential and badly needed fertilizer. Such government-owned and operated plants are in direct competition with private industry. Those of us who are interested in the welfare of agriculture are naturally in favor of more, better, and cheaper fertilizer but, at the same time, we are most anxious for private industry to have an opportunity to function and to perform to the utmost of its capacity. Once we break away from the basic and fundamental principle of free private enterprise, it will be easier to do so again to the detriment of other industries.

There is little point in criticizing Great Britain because it has adopted a form of socialistic government; nor Russia because of its statism. The United States can go down the road to either or both if we put the government in business. Private industry has done a good job in the manufacturing of commercial fertilizers. Its work should be encouraged. The plant food industry must keep the good will of the farmer in producing the supply of fertilizer he needs. It can be done if our free enterprise system is permitted to carry on without the further interference and encroachment of government. When the American farmer sees that private enterprise is fulfilling his needs and is doing a better job than the government could do, he is surely going to remain on the side of private enterprise where he traditionally and conscientiously belongs. In the last analysis, the American farmer wants to be counted on the side of free enterprise which has made America the greatest industrial nation in the world.

Remarks by Rep. Charles B. Hoeven (R) Eighth District of Iowa on the agricultural forum on "Fertilizer, Farming and the Future" at the fourth annual convention of the American Plant Food Council, Bretton Woods, N. H., June 20, 1949.

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Initial Flavor and Odor Studies with

Benzene Hexachloride

By S. A. Rohwer

Assistant Chief
Bureau of Entomology and Plant Quarantine,
U. S. Department of Agriculture,
Washington, D. C.

INITIAL tests with technical benzene hexachloride, containing the various isomers as well as traces of other chlorinated hydrocarbon compounds, disclosed that the technical chemical was toxic to many species of insects and that it held promise of being an effective insecticide. It was soon discovered that its use caused an objectionable flavor and/or odor in the harvested edible portion of some crops. In some cases this was true regardless of whether the chemical had been placed in the soil in which the crop was grown, or applied directly to the vegetative, above-ground part.

Research has indicated that of the five isomers of benzene hexachloride, the gamma isomer is primarily responsible for its insecticidal activity. In its pure form, gamma isomer does not have the characteristic musty odor associated with technical BHC.

To determine the role played by each isomer or a mixture of all isomers in bringing about the objectionable flavor or odor of fruit and vegetable crops, a cooperative research program was initiated during the summer of 1948 to study the behavior of the chemically pure isomers, alpha, beta, gamma and delta.

These studies were made jointly by the Bureaus of Entomology and Plant Quarantine and of Human Nutrition and Home Economics of the U. S. Department of Agriculture and the Research Department of the California Spray-Chemical Corporation.

The experiments were conducted in Maryland and New Jersey. The individual tests were not sufficiently complete by themselves to justify detailed publication of the results. The general conclusion indicated from the results of each test is so similar that it is reasonable to assume it is basically correct. This summary of the results is made available as an aid to others who may be planning further experiments with benzene hexachloride.

The isomers were prepared by recrystallization from organic solvents and were checked for purity by melting point determination and by infra-red spectrometer analysis. Each isomer was formulated into a twenty-five percent wettable powder through the same grinding equipment, and using the same wetting agent and diluent. Every possible precaution was taken to insure freedom from contamination. The four pure isomers were also mixed in the proportion found in the technical benzene hexachloride from which they were derived, and formulated into a similar wettable product. The inert used was a Fuller's Earth, having a pH of approximately seven.

Personnel who formulated the different isomers found gamma to be relatively odorless and non-irritating. The alpha, beta and delta isomers caused various degrees of irritation to the eyes, nose, throat and skin.

Experiments were conducted by three different techniques and using normal and heavier dosages to increase the probability that off-flavor would result from some treatments. The experiments were as follows:

(1) Dusts containing 10 percent by weight of the isomer were prepared and applied to the following vegetable crops, three applications being made at one week intervals during the growing season of the crop in question: Rhubarb, spinach, broccoli, sweet corn, tomatoes, snap beans, lima beans and potatoes. In each case, the dusts were applied to the developing fruits or foliage that was to be eaten, except in the case of potatoes.

(2) The wettable powders, at dosages in the approximate proportion that the isomers existed in the original benzene hexachloride, were incorporated in sassafras loam soil in three gallon glazed crocks, in which potatoes, tomatoes and lima beans were grown.

(3) The wettable powders were compared in sprays applied to peaches 18 days prior to harvest at dosages in the approximate proportion that the isomers occurred in the original benzene hexachloride.

The edible part of each experimental crop was harvested in a normal manner, and, under code, its odor and taste scored, usually both in raw and cooked or processed form. The method of scoring samples was not uniform for the three experiments. The number of individuals for the purpose, the manner of their selection, and the procedure they followed were

(*Turn to page 75*)

(1) The author's relation to the work was restricted to implementing the tests and arranging for the preparation of this summary.

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Weed Control
—in small fruits

By R. F. Carlson

Department of Horticulture,
Michigan State College,
East Lansing, Mich.

SMALL fruits, especially strawberries and raspberries, require a great amount of labor in the control of unwanted weeds. Considerable preliminary research has been done in recent years using various chemicals for weed control. The initial work using 2,4-D to control weeds in strawberries was reported in 1947 (1), and showed that strawberries were relatively resistant to 2,4-D. It was suggested that this material might be used effectively as a selective spray for weed control in the strawberry bed. At the 1947 annual conference of the North Central Weed Control Conference, Viehmeyer (6) confirmed this work and reported varying degrees of tolerance to 2,4-D among hybrid and commercial varieties of strawberries. Otis (5) used one quart of Dinitro-o-sec-butylphenol (Dow General) and 30 gallons of Diesel Oil in 100 gallons of water to control annual weeds in strawberries. This formation burned the foliage of both weeds and strawberry plants, but the latter recovered. Three periods for applications of this material were suggested by Otis, namely; (1) Early spring before growth begins, (2) in summer immediately after harvest, and (3) in fall prior to killing frost.

TABLE 1

Comparative lengths of raspberry canes from plots treated with TCA at different times and at different rates per acre, the effect of treatments on leaves of the raspberry plant, and effect on the grasses. Observations made: September 6, 1948.

Date of Application	Pounds Per Acre	Cane length in inches	Leaf Chlorosis	Effect on Grasses	
				Quack grass	June grass
November 10, 1947	10	45.9	None	X	X
	30	44.5	Slight	O	X
	60	46.4	Slight	O	O
	Check	44.3	None	XX	XX
April 28, 1948	10	43.2	Slight	X	X
	30	40.4	Medium	O	X
	60	33.0	Medium	O	O
	Check	42.8	None	XX	XX
July 6, 1948	10	39.0	Slight	X	X
	30	43.6	Medium	O	X
	60	38.8	Serious	O	O
	Check	41.6	None	XX	XX

XX = Matted with grass.
X = Reduction in stand of the grass.
O = Complete control of the grass.

In 1947, Gilbert (4) used 2,4-D both in pre-planting and post-planting applications on the Sparkle and Pathfinder varieties. The pre-planting application of 2 pounds per acre retarded the growth of grasses and weeds for 6 weeks without any noticeable ill effect to the strawberry plants. Post-planting applications made June 20 and September 20, at 1.5 and 1 pound per acre, respectively, gave good control of the broad-leaved weeds without injuring the strawberry plants. Although the data are not completed, Gilbert states that beds of the Sparkle and Pathfinder strawberries have indicated a favorable response to both pre-planting and post-planting applications of 2,4-D.

Neville *et al.* (5) used the sodium and ester formulations of 2,4-D at rates ranging from ½ to 2 pounds per acre of the acid on the Catskill, Fairfax and Premier varieties. One month after application these varieties compared favorably in growth and appearance to the untreated strawberry plants.

A limited amount of work has been done in the control of annual weeds and grasses in raspberry plantings including unreported trials with 2,4-D. The annual weeds are easily controlled at herbicidal concentrations of 2,4-D, but formative affects occur on new shoots of raspberries. By proper timing of applications it is possible that 2,4-D can be used in commercial plantings. Grasses have also been controlled in raspberry plantings by the use of general contact herbi-

*This paper was presented at the fifth annual North Central Weed Control Conference, Springfield, Ill. December 1948.

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cides of the dinitro formulations, but control is not lasting since only surface growth is killed. Recent studies (2) have indicated that "TCA" (Trichloroacetate) possibly could be used in the control of grasses (quack grass and Kentucky blue grass).

Strawberry Response to 2,4-D

SINCE 1947 when the preliminary work with 2,4-D to control weeds in strawberries was reported (1), a great deal of field work has been done testing different formulations, different rates per acre, and tolerance of various varieties. In the spring of 1948, six varieties of strawberries (Gandy, Massey, Premier, Robinson, Sparkle, and Temple) were planted for this purpose.

Two applications of 2,4-D at the rate of one-half pound per acre of acid equivalent were made during the summer as water sprays under commercial field conditions. The first application was made two weeks after the plants were set and the second was made five weeks following the first. The field was cultivated one week prior to each application, and the soil surface received some of the spray solution. Lambsquarter (*Chenopodium album L.*), Dandelion (*Taraxacum officinale L.*), and Spurry (*Spergula arvensis L.*) were destroyed by the treatments.

The differences between varieties, although slight, were noticeable. Observations were based on examinations of the plants at the end of the growing season. Leaves, runners, crowns, and roots of plants from the treated rows were carefully examined and compared to plants from the check rows. The differences between the varieties were small, that is, there was a degree of curling of the leaves and a slight browning of the roots which was attributed to the 2,4-D treatments. The varieties are listed in decreasing degree of tolerance as follows: Robinson, Sparkle, Temple, Premier, Massey and Gandy. By the end of the growing season the production of runners by the treated plants compared favorably with the check plants.

Commercial Applications

DURING the summer of 1948, several growers in Michigan used 2,4-D at low concentrations to control annual grasses in first-year plantings of strawberries. One grower, Thomas Moss of Kent County, sprayed five acres of Robinson and Premier at the rate of one-fourth pint of a 40-per cent amine formulation of 2,4-D per acre. The application was made May 1, or one week after planting. Mr. Moss reports, "After spraying we did not have to hoe the berries until the middle of June, saving at least one hoeing. I think that if I had cultivated the berries after each hoeing and had applied 2,4-D, I would have saved two hoeings which cost $45.00 each." No serious injury was reported from any growers using 2,4-D at low concentrations and with a low volume of spray per acre.

From the tests previously mentioned and from information from reliable growers it seems that 2,4-D (at one quarter to one-half pound acid equivalent per acre) can be recommended for use on the first-year strawberry bed. The spray should be applied with low volume nozzles (approximately five gallons of the water solution per acre) because of minimum wetting of strawberry plants. High volumes per acre are likely to cause the herbicide to soak or run into the crown, and produce injury to the strawberry plant. Two applications during the season may be advisable, depending on the severity of the problem and the tolerance of the variety grown.

Chickweed in Commercial Strawberry Plantings

COMMON chickweed (*Stellaria media (L.) Cyrill*) often becomes a serious problem in commercial plantings of strawberries in some sections of the country. In some cases, the second crop of fruit has been abandoned because of the prohibitive cost of eliminating this weed by hand. Due to its creeping habit it soon spreads over a large planting and becomes a matted mass both in the row and between the rows.

In 1947, 2,4-D was tried as a control measure as soon as the chickweed appeared in late September, and again in late October. However, the chickweed was resistant to 2,4-D both at the seedling stage and when in full foliage and no satisfactory control was secured.

Further testing, including other materials such as the dinitro compounds, IPC and combinations of IPC and 2,4-D, was continued in the fall of 1948. IPC (Isopropylphenylcarbamate) was included because it had been observed previously that the common chickweed was killed by it when used on quack grass on lawns. The dinitro compounds was used because of the favorable response secured by Otis (6).

Applications of IPC at the rate of 5, 10, 15 and 25 pounds per acre were made in September, when the chickweed had emerged, and in October and in November. The IPC was diluted with talc and applied as a dust over the row. One month after the application the chickweed was dead in the rows that received the 10-, 15- and 25-pound applications, while some was still alive in the rows that received the 5-pound rate. At that time, it appeared that the strawberries in the rows that received the 25-pound rate had been injured slightly, whereas the rows that were treated at the rate of 5, 10, and 15 pounds per acre were unaffected.

The applications of the other materials previously mentioned were made later and no data are as yet available.

Problem in Raspberries

THE broad-leaved weeds as a rule do not cause too much trouble in raspberries, especially where the hill-system of growing is employed. In some locations

(*Turn to page 71*)

Western Entomologists at Arizona Meeting Discuss

AGRICULTURAL PEST CONTROL

By Dr. Alvin J. Cox

Part II

This report concludes Dr. Cox's story of the Pacific Slope Branch, A.A.E.E. meeting held at Grand Canyon, Arizona, June 16-18. Part I carried a review of the papers presented at the first session. We now continue with the program beginning with the afternoon session of June 16, with Dr. J. N. Raney, University of California, as chairman.—Ed.

"THE Oriental Fruit Fly from the Mainland Viewpoint" was the subject of a paper by H. W. Armitage at the opening of Thursday afternoon's session. He pointed out that the pest has only recently made its appearance in the Hawaiian Islands, but has increased its numbers to an almost unbelievable extent. Its importance overshadows the Medfly in the lowlands, the fast expansion being largely due to its being introduced into a favorable habitat without the factors which kept populations down in its native home. The Oriental fruit fly has over 100 hosts which range from Macadamia nuts to strawberries. Apparently any above-ground, fleshy fruit, vegetable or seed is a potential host.

Preliminary tests show DDT to offer the most effective control of the pest, if application is repeated every five days for residual effect.

If given the opportunity Oriental fruit fly could survive along the coast of California from San Francisco to San Diego, including most of the southern part of the state, the southern tip of Texas, and the lower half of Florida, it was pointed out.

Dr. Armitage suggested that in order to control this pest, there should be an intensified world search for predators and parasites; development of chemical field treatment; finding ways to treat fruit and vegetables to assure their safe movement to clear areas; and the development of better lures and traps in suspected areas. "The solution to these problems offers a real challenge to entomologists", he concluded.

C. P. Clausen, Chief, Foreign Parasite Introduction, U. S. Bureau of Entomology and Plant Quarantine, Washington, D. C., presented an invitational paper entitled: "New Biological Control Projects in the Bureau of Entomology and Plant Quarantine." He said that the Oriental fruit fly had spread more and more and now only the gap from Honolulu to the mainland is left to complete its spread across the Pacific. There should be cooperation and participation of all interested parties in a single control project. Five federal territorial and private agencies are now operating that way in Honolulu, he reported.

Entrance of the citrus black fly is much more imminent than the Oriental fruit fly as there is no sea barrier. It was introduced into Mexico in 1935, and since then has spread east and west until it is now within 250 miles of the United States' border. Biological methods present the best prospect of halting the further spread of the fly, he said.

W. R. Thompson, Director, Commonwealth Bureau of Biological Control, Ottawa, Canada, without a prepared paper, discussed "The Scientific Development of Biological Control". He stated that his own field in the organization with which he is working is to search for, collect and supply material. Such work is highly empirical, he said, and continued by remarking that it is difficult to predict results

In the photo (left) Professor Harry Smith, University of California, Riverside; and Dr. W. R. Thompson, director, Commonwealth Bureau of Biological Control, Ottawa, Ontario, Canada. Both were speakers at the Grand Canyon meeting.

Left to right: Dr. E. F. Knipling, U.S.D.A., Washington, D. C.; Dr. A. M. Boyce, U. of California, Riverside, president of A.A.E.E.; Dr. Curtis Clausen, U.S.D.A., Washington, D. C.; and Dr. J. N. Roney, Phoenix, Arizona. All had important parts on the program.

from biological control. Many of the parasites or predators may not survive, and if they do, the question is, how effective will they be?

Mr. Thompson gave some examples of biological control, and told of some occasions where the application of sulfur had killed the parasites and of course increased the population of unwanted pests. The introduction of *Rodolia* brought its hosts under control, and when Coccinilids were imported to control the pests of Bermuda cedar, the pests disappeared completely except one species which appears to be nearing the control level. In making use of predators, one must know their life habits, particularly of reproduction. So many variables are present, however, that it is difficult to measure the effect obtained from biological control.

A. F. Kirkpatrick, Entomologist at the San Francisco branch of American Cyanamid Company, presented a paper, "Factors Influencing the Use of Parathion".

He said that the rate at which the residues decrease is influenced by the type of plant and the weather factors in the particular location at the time. Parathion residues decrease very largely as a result of volatility from the plant surfaces. The last application must be made at least thirty days before harvest, or before the formation of the edible portion of certain rapid growing crops, such as snap beans.

D. L. Lindgren and L. E. Vincent, University of California, Riverside, presented "Investigation on the Life History and Control of Date Insects and the Date Mite". Of the five thousand acres of dates grown in the United States, over 4,000 are in Coachella Valley, where twenty to thirty million pounds are produced annually, the paper stated. The loss from insects and fungi ranges from ten to eighty per cent. The paper gave life histories, at the temperatures existing in the Coachella Valley, of four species of Nitidulid beetles as the most injurious, two species of which account for 98% of beetles found in dates. Experiments conducted both in the laboratory and in the field for the control of insects and mites on dates were described, with the notation that they move in from grapefruit, corn and other crops. Many new materials were tested for possible use as control measures.

Pacific Slope Officers

The following officers of the Pacific Slope Branch, A.A.E.E., were named at the Grand Canyon meeting in June:

H. M. Armitage
Chairman

Ed. H. Littooy
Vice-chairman

Roy E. Campbell
Sect'y-Treasurer

W. Ebeling and R. J. Pence, University of California, Los Angeles, presented a paper entitled: "Some Factors Affecting Greenhouse Thrips Populations on Avocados". The greenhouse thrips, *Heliothrips haemorrhoidalis* Bouché, is one of about twelve species that attack avocados. It also attacks oranges in the coastal regions. Damage is not to the tree, but results from the scarring of fruit. Its population density fluctuates from year to year, but the eggs are never more than 50% parasitized.

"Codling Moth Investigations on the Payne Variety of English Walnut in Northern California" was discussed in a paper by A. E. Michelbacher and W. W. Middlekauff, University of California, Berkeley. A single spray of standard lead arsenate was found to be about as effective as two sprays of basic lead arsenate, they declared. The addition of an aphicide to the early codling moth spray proved beneficial.

"Comparisons among Acaricides for Apples and Pears" was presented by M. M. Barnes, University of California, Riverside. Development of large populations of mites invariably follows when DDT is used on apples and pears in southern California, he reported. Comparisons among dilute sprays for

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the control of Pacific mite on pears, and European red mite, two-spotted mite and clover mite on apples were presented. Parathion is outstanding as a supplement to DDT sprays because of its general acaricidal and insecticidal properties, it was pointed out.

"Processing Aromatic Chemicals as Solid Baits for Timing Seasonal Cycles of Codling Moth and Other Insects" was given by J. R. Eyer and E. J. O'Neal, New Mexico State College of Agriculture, State College, N. M. There are two generations of codling moth in the northern, three in the central, and four in the southern part of the state annually, the paper stated. Use of safrol in various concentrations is most promising and affords more consistent attractants. It possesses selective action and the results are the same in both warm and cooler areas. Syrup baits attract flies while safrol attracts very few. Solid baits of safrol and n-butyl sulfide using sawdust, apple pomace or sassafras bark as carriers and plaster of Paris or Liquid Curbay as binders have proved to be more selective than fermenting molasses as codling moth baits. Di-phenyl alanine or powdered vetch, similarly processed, are promising as attractants for Mexican bean beetle, and isobutyl phenyl acetate for some species of cutworm moths.

In responding to the title "New Insecticides Used for the Control of Orange Tortrix and other Orangeworms on Citrus during 1947-48 in Southern California," E. L. Atkins, Jr., University of California, Riverside, showed lantern slides giving comparative data on thirteen of the newer insecticides employed for the control of the orange tortrix, pyroderces and holocera orangeworms on citrus. Cryolite, DDD and parathion were the most promising against the orange tortrix and holocera; DDD and parathion were the most promising against pyroderces, he said.

M. M. Barnes, C. G. Gammon, and D. W. Robinson, University of California, Riverside, and Bureau of Entomology, State Department of Agriculture, Bostonia, California, presented "Western Grape Leaf Skeletonizer Investigations" in San Diego County. These studies were in support of an eradication project and to develop information on the species in event of its spread to major vineyard areas. Details of the life history and seasonal development were presented.

Of eleven formulations tried, 50 per cent cryolite was selected for general use in eradication. Methoxychlor offers promise of use where a residue problem is involved. Of thirty attractants, the three best were methyl anthranilate, anisic aldehyde, and ethyl oenanthate.

Extension Entomologists Meet

TOPICS discussed at the open meeting of extension entomologists on Thursday evening covered fly control; control of external parasites on livestock; the uses and nomenclature of insecticides; bees and insecticides and extension demonstration vs experimentation.

It was brought out that many flies in Arizona and California are resistant to the chlorinated hydrocarbon insecticides, but that four pounds of 6% gamma BHC was effective against adult lice and eggs. The existing confusion on the subject was referred to frequently, and a conference for discussion of livestock pest control was voted to be held in the fall.

Internal Treatment Described

DR. E. F. Knipling, Chief, Division of Insects Affecting Man and Animals, U. S. Bureau of Entomology and Plant Quarantine, Washington, D. C., presented an invitational paper entitled: "Recent Investigations on Internal Treatments for Controlling External Animal Parasites." He pointed out numerous cases where this method of control has proved successful. Among these were tests at Orlando, where DDT fed to a rabbit killed bedbugs that fed on it. BHC fed to the host at the rate of 250 milligrams per kilogram of body weight for each of two days; and one-half of this dose for each of two more days, killed tsetse fly. It was found to be possible to control blood sucking insects by previously introducing a toxicant into the blood of the host. Blood has been made toxic for four or five weeks against body lice. It acts the same whether administered intravenously, intermuscularly, or orally. No repellent action or effect has been found, however.

No internal treatment against cattle-grubs in the early stages has been found, but a technique has been developed that will enable such experimentation to be carried on. Progress made in the past five years affords a line of attack that may lead to success. Research has been carried on as to the toxic effects of getting chemicals into the host plant or animal.

In responding to the subject "Effect of Temperature on the Insecticidal Action of Some Compounds on the Sheep Tick and Studies on Sheep Tick Migration," Robert A. Hoffman, Adolph R. Roth, and Arthur W. Lindquist, the last named speaking, said that in laboratory tests DDT, methoxychlor, and TDE produced a considerably higher mortality of the sheep tick at 70° than at 90° F. Toxaphene, BHC and chlordane produced a reverse effect, i.e., caused a higher mortality at 90°, when held for twenty hours, than at 70°. Best results were when the weather was warm and the wool was not very long.

D. G. Denning, University of Wyoming, Laramie, used lantern slides to illustrate his talk on "Dusting for Sheep Tick Control." In the past there has been no extensive control of sheep tick in Wyoming because it is cold and water is frequently not available when the sheep are handled, he said. Describing tests for control by treating sheep with rotenone ½% dust immediately after shearing, he said that two thousand per

hour were handled, 0.1 pound of toxicant per head was applied at a cost of one cent.

Robert A. Hoffman, U. S. Bureau of Entomology and Plant Quarantine, Corvallis, Oregon, presented a paper entitled, "Laboratory Studies on Emergence and Longevity of Sheep Tick, *Melophagus ovinus* L." He reported that both temperature and humidity enter into the problem. Sheep tick puparia were collected from sheep and stored at different constant temperatures for studies on emergence and adult longevity. At temperatures of 70, 80, and 90 F. the average life span was 63, 80, and 38 hours respectively. Continuous exposure of puparia to temperatures of 40 F. prevented emergence of adults. The data presented indicate optimum emergence is between 80 and 90 F. and that adults survive longer at temperatures below these.

Fly Resistance Noted

R. B. March, Junior Entomologist, University of California, Riverside, presented an invitational paper entitled, "Laboratory and Field Studies of DDT Resistant Houseflies in Southern California." When DDT began to fail in the control of flies, some conjectured that current production was inferior or that the material had deteriorated in storage. Data show that if the LD50 for laboratory reared flies is taken as unity, then the resistance for flies from four localities in California is: Riverside 13, Ontario 14, San Jose 23, and Bellflower 333. Experiments in progress to develop resistant strains in the laboratory show that in the seventh generation flies had increased their resistance to BHC about three times.

W. M. Hoskins and A. S. Perry, University of California, Berkeley, presented a paper, "The Effect of Concentration of Sprays upon Toxicity to Houseflies." Tests with a precision sprayer show that the mortality is dependent not only upon the amount of toxicant applied to a housefly but also upon its concentration in the spray, the paper said. Females require twice as much toxicant as males. With pyrethrins, "Lethane 384" or DDT in kerosene, the mortality per unit of toxicant increases several fold as the concentration decreases.

N. B. Akesson, Junior Agricultural Engineer, University of California, Davis, presented an invitational paper entitled: "Recent Developments in Insecticide Application Equipment." He reported that a revolution has been caused by the use of air dilution equipment. Much work has been done (1) on the production, (2) carrying or propagation, and (3) deposition of the particle. The second has had the least work done on it. With a pressure of 800 pounds per square inch, the micron size is 200; and with 400 pounds per square inch, 400 microns. When droplets are reduced to half diameter there are eight times the number.

The high velocity low volume machines require a 200-mile per hour air stream. Dusters use 20,000 cubic feet of air per minute. Aerosol equipment is becoming obsolete, as blowers are needed to get the spray into the tree. The deposit is influenced by the velocity of the particles themselves, their size, and size of object being treated. A very high turbulent condition at point of deposit gives the greater deposit. Although helicopters are slower flying, they have no advantage over fixed wing planes on low growing crops, Mr. Akesson said. Generally speaking, aircraft do not give as good results as a ground rig, he concluded.

"Insect and Residue Problems of the Food Industry" were discussed by C. H. Mahoney, Director, Raw Products Research Bureau, National Canners Association, Washington, D. C. Canners do not make any recommendations or ask for any, Mr. Mahoney declared. The responsibility of the food processor begins when he puts his name on a food package, and the problem is far from being merely academic. Off-taste and flavor caused baby food manufacturers to dump $200,000 worth of canned goods last year, he recalled.

Canners now realize that insect control is necessary, but those who apply insecticides must be responsible and keep in mind the marketability of the crop. There are no tolerances for canned foods; only for apples and pears, so canned food should be free from toxic residue. The Food and Drug Administration will never be able to set up a DDT tolerance for every product, Mr. Mahoney said. The food technologist and the horticulturalist should cooperate with the entomologist in working out solutions to these problems.

Canners should follow the advice of the State Experiment Station to the letter. Give the experiment stations responsibility but give them authority at the same time, Mr. Mahoney urged. Since the Food and Drug Administration is the regulator, canners should also get its best advice.

K. E. Maxwell, Riverside, California, and A. F. Swain, Eston Chemical Company, Los Angeles, California, presented a paper entitled, "Studies on Tetraethyl Pyrophosphate." Extreme instability of TEPP in the presence of moisture is against the use of the material as an insecticidal dust, he reported. Various diluents, such as calcined gypsum and magnesium carbonate, and conditioning agents were used. The mixtures were sampled periodically and tested in the laboratory as to biological effectiveness. Pumicite ("Frianite") looked promising. Among the most effective materials tested on flies and aphids following prolonged storage periods were those containing tetraethyl pyrophosphate, "Frianite," and "Textron DX," a tetraethyl pyrophosphate stabilizer which they have developed.

Curtis Ferris read a paper entitled, "Preliminary Observations: Effects of Parathion on Plants"

by D. B. Scott, Jr., Sherwin-Williams Company, Oakland, California, in the absence of the author. The usefulness of parathion may extend outside purely agricultural fields, therefore, phytotoxicological data for ornamentals should be made available, the paper stated. Without minimizing the inherent toxicity of parathion, information indicates that it is less hazardous and less toxic than originally anticipated.

"The Effect of Soil Type on the Nematicidal Action of Soil Fumigants" was the title of an invitational paper by M. W. Allen, Assistant Nematologist, University of California, Berkeley. Cultural practices are important in the control of nematodes, but when these are insufficient, soil fumigants may be employed, he said. Carbon disulphide and calcium cyanide are effective if enough is used. Chlorpicrin may be used if the gas can be controlled. The author pointed out that for the past few years ethylene dibromide, and dichloropropene mixtures have been available. Ten to fifteen gallons of the former and two hundred pounds of the latter per acre will usually control root-knot nematode.

The soil itself is the greatest factor in nematode control. Two hundred fifty pounds of dichloropropene per acre gave good control of both root-knot and sugar-beet nematode in Fresno sandy loam and in Yolo fine sandy loam. The control in Yolo silt loam and in Yolo clay loam was fair; there was no control in Egbert organic loam and in Bowers clay there was very little control of root-knot nematode and much less of beet nematode. In Fresno sandy loam all sugar beet nematodes were killed.

"Seed Treatments for the Control of Wireworms" was the title of a paper by W. H. Lange, Jr., E. C. Carlson, and L. R. Leach, University of California, Davis. The coating of seeds in 1946 with BHC gave remarkable control, he reported, and stated that progress will be made when insecticides and fungicides can be combined to prevent decay. There is some phytotoxicity as shown by reduced germination in an occasional crop. Different species of wireworms have different susceptibilities, *Limonius californicus* being the most difficult to kill. Twenty-five percent gamma BHC is the most effective of three materials tried. It may be combined with certain fungicides to give wireworm control and prevent seed decay.

"Salt Marsh Caterpillar Control in Arizona" was presented by W. A. Stevenson and L. W. Sheets, U. S. Bureau of Entomology and Plant Quarantine, Tucson, Arizona. Salt marsh caterpillar populations numbered into the millions in cotton of the Salt River Valley of Arizona in the fall of 1948. Some damage was done in late planted cotton fields; in other cotton fields merely cheap defoliation was obtained. A mixture of toxaphene 15% and DDT 5% gave the greatest mortality of the materials tested.

"The Biology of a Potato Pest, The Ragweed Plant Bug, *Chlamydatus associatus* (Uhler)" was the subject of a paper by K. E. Hughes, University of California, Riverside. A summary of the life history of the ragweed plant bug was presented, with the statement that from 1940 to 1948 it was the most abundant potato pest in central and western Nebraska. It is easy to control on commercial crops by dusts and sprays, such as sulphur and lime sulphur, Mr. Hughes said.

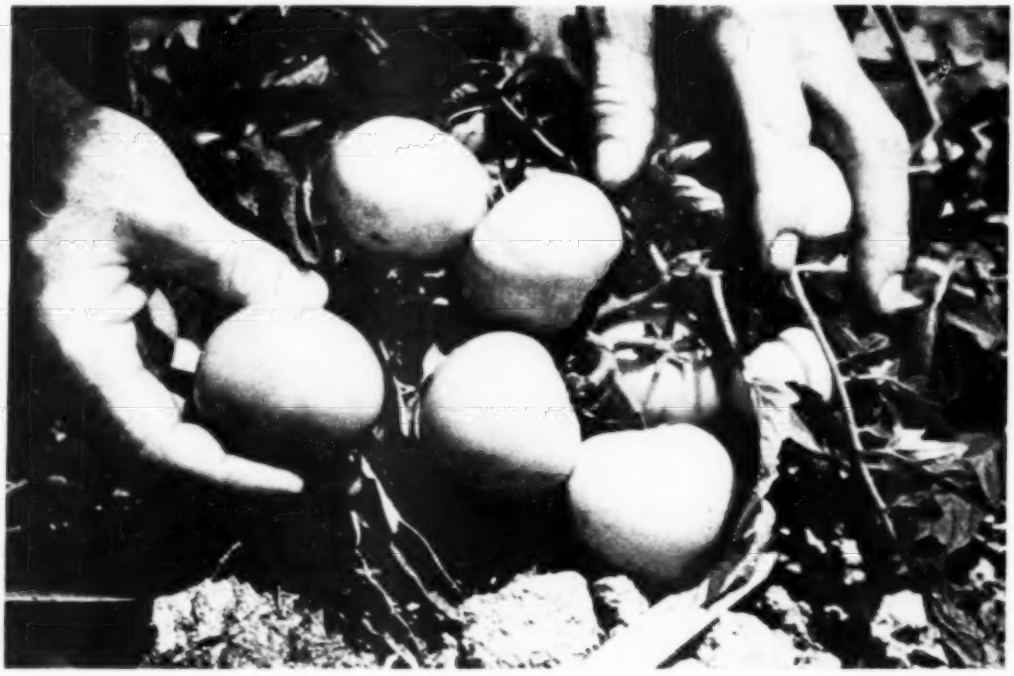
The paper entitled, "Potato Tuberworm Control on Potatoes" by L. D. Anderson, H. T. Reynolds and J. W. Hashe, University of California, Riverside, was read by Mr. Reynolds. When potato tuberworms became a serious pest on potato foliage in the Nuevo area, experiments were made in which 5 per cent DDT, 5 per cent DDD, 10 per cent chlorinated camphene, 1 per cent purified gamma isomer of benzene hexachloride, and 5 per cent chlordane were used at forty pounds per acre per application. All materials except chlordane gave almost perfect control by the time the second application was made. Benzene hexachloride gave almost 100 per cent control within twenty-four hours of the first application. No tuberworms were found in any of the tubers at harvest time, but a slight off-flavor occurred in the benzene hexachloride treated potatoes at digging time.

The paper entitled "Corn Earworm Control on Sweet Corn in Southern California" by the same authors as the previous paper was presented by L. D. Anderson. Individual ear treatment with a dust composed of DDT 3 per cent plus oil 2 per cent applied 3 to 4 times at 3 to 5 day intervals, using from 35 to 40 pounds of dust per application, resulted in from 80 to 90 per cent worm-free ears, he reported. Untreated ears ranged from only 1 to 15 per cent worm-free. No DDT residue was found on the edible portion of the ear. Parathion and DDD were found to be slightly less effective than DDT.

"The Effect of the Addition of Sulfur to DDT Dusts for Onion Thrips Control" was presented by J. Wilcox and A. F. Howland, U. S. Bureau of Entomology and Plant Quarantine, Alhambra, California. DDT dusts mixed to include 25 per cent sulfur were no more effective against the onion thrips than dusts without sulfur. But the use of 50 and 75 per cent sulfur in the carrier of the DDT increased the effectiveness.

R. L. Metcalf, Assistant Entomologist, University of California, Riverside, presented an invitational address entitled, "Toxicological Studies of Organic Phosphate Compounds." These compounds are interesting because of the great variety of chemical structure which may be altered in many ways. Toxicological data show that TEPP and parathion inhibit the cholinesterase enzyme involved in transmission of nerve impulses, resulting in tremors. Data compar-

(*Turn to page 73*)



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The Listening Post

Control of Varied Root Diseases is Studied

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Survey, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Md.

By Paul R. Miller

EXPLORATORY soil disinfection trials against a perplexing root disease in southern pine nursery beds revealed two treatments that greatly reduced the root trouble and one that gave striking control of weeds, according to Ralph M. Lindgren and Berch W. Henry of the U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering. The work was done at the W. W. Ashe Nursery near Brooklyn, Mississippi, in cooperation with Region 8 and the Southern Forest Experiment Station of the U. S. Forest Service.

The condition known as "root rot" at the nursery, involves symptoms that could easily result from more than one cause. Poor survival of infected seedlings in field plants, rather than high mortality in nursery beds, usually has been of greatest concern.

Sixteen soil treatments and an untreated control were compared in 4 - 5-foot plots in standard nursery beds. These treatments were randomized in each of three blocks for two tree species, longleaf pine (*Pinus palustris* Mill.) and slash pine (*P. caribaea* Morel.). All fungicidal materials were well distributed to at least a 6 inch depth in the soil. The top 4 inches of soil was removed and one-half of the total chemical for each plot was worked or watered into the soil at the lower bed level. The soil removed was then replaced and the remaining one-half of the chemical was distributed through the top 4 inches of soil. Before applying, dry chemicals were mixed with about 100 times their volume of dry sand. After spreading and working in, a water drench of one pint per square foot at the lower bed level and one quart per square foot on the completed plot surface, was applied. Liquid materials were diluted with enough water for an application of one pint and one quart of solution per square foot to the lower and completed bed surfaces, respectively. The three fumigants, chloropicrin, DD, and ethylene dibromide, were applied to holes about 6 inches deep and staggered 10 inches apart. The treated holes were packed with soil immediately

TABLE I

Weighted mean numbers of seedlings per square foot and percents of seedlings with rotted and healthy roots in three replicated series of longleaf and slash pine plots treated with various soil disinfectants. Seedlings were classed as plantable on the basis of size and not on the presence or absence of root disease.

Treatment & Amount Per Acre		Seedling Stand				Proportion of Seedlings Infected and Healthy					
		Longleaf pine		Slash pine		Longleaf pine			Slash pine		
Material	Approximate Amount	Per sq. ft.	Plantable	Per sq. ft.	Plantable	Severe rot	Light rot	Healthy	Severe rot	Light rot	Healthy
	Lbs.	no.	%	no.	%	%	%	%	%	%	%
Allyl alcohol (IscoAA)	260	11.9	95.0	47.1	80.0	43.5	35.3	21.2	21.6	47.0	31.4
Chloropicrin (Larvacide)	575	9.9	96.0	33.5	83.3	1.3	17.1	81.6	1.1	33.3	65.6
DD dichloropropanes & propenes (Dowfume N)	500	4.7	91.5	33.1	77.9	54.6	40.9	4.5	23.5	41.3	35.2
Ethylene dibromide (Dowfume W 40)	360	5.5	94.5	33.3	78.4	0	4.7	95.3	2.3	31.6	66.1
Ethyl mercury iodide (5% in talc)	150	8.6	88.4	37.5	81.9	52.9	42.2	4.9	16.6	51.3	32.1
Ferrous sulphate	4000	8.3	81.9	42.3	73.3	66.4	24.5	9.1	31.4	47.6	21.0
Formaldehyde (40%)	2700	10.2	92.2	33.9	86.4	48.3	40.4	11.3	8.0	36.5	55.5
Sodium ethylene bisdithiocarbamate (Dithane D-14)	150	5.4	85.2	37.4	79.4	80.4	18.6	1.0	22.1	51.3	26.6
Zinc trichlorphenate	150	6.8	95.6	35.2	81.8	44.7	49.4	5.9	23.4	50.7	25.9
Untreated control		6.4	90.6	36.9	77.8	81.3	18.7	0	28.8	43.8	27.4

and a water seal of one quart per square foot was given to the plot surface.

Beds were sown on March 18, 1947, which was at least two weeks after the application of any of the treatments. The stand of longleaf pine seedlings was abnormally low, because of poor seed and severe rain washing. Seedlings were lifted on January 15 and 16, 1948, and field plantings of test material were made by U. S. Forest Service personnel shortly thereafter. Full data on field survival are not yet available.

Rates of application of the chemicals, seedlings per square foot and amount and type of root rot for nine treatments are shown in the accompanying table. The seven other treatments were: salicylic acid at 240 lbs. per acre; ferric dimethyldithiocarbamate ("Fermate"), tetrachloro-para-benzoquinone ("Spergon", wettable), tetramethyl thiuramdisulphide ("Arasan"), and zinc ethylene bisdithiocarbamate ("Dithane Z-78")—each at 150 lbs. per acre; formaldehyde at 2700 lbs. plus fertilizer at three equal rates on June 10, August 13, and October 6, with a total application of 80 lbs. N, 400 lbs. P_2O_5 and 240 lbs. K_2O per acre; ethyl mercury iodide (5%) at 150 lbs. plus fertilizer as described previously. The results obtained with these materials in root disease control were no better than those for the least promising treatments listed in the table.

Two fumigants, chloropicrin and ethylene dibromide, were outstanding in control of the troublesome root disease. Plots treated with these materials showed practically no severe rot and very little of the light type. In contrast, over 80 percent of the untreated longleaf pine seedlings were severely rotted and none were healthy. Formaldehyde and allyl alcohol appeared to rank next in effectiveness but were significantly inferior to the two fumigants. The various fungicidal treatments and the fumigant DD were largely or entirely ineffective.

Control by two fumigants and the failure of a number of strongly fungicidal materials point to nematodes as a contributing factor in the root disease problem. Partial control by formaldehyde, which reportedly has some nematocidal value, and by allyl alcohol, which could easily function similarly under the deep application methods used, strengthens the evidence.

Striking control of weeds was obtained until middle June in all plots treated with allyl alcohol. Two early weedings were eliminated and subsequent work in keeping the plots clean was greatly reduced. Of the remaining treatments, only zinc trichlorphenate showed a clear-cut reduction in weeds, but its effect was markedly inferior to that of allyl alcohol.

The weed control properties of allyl alcohol are distinctly promising for forest nursery use, provided this toxic chemical can be handled safely and yearly applications result in no deleterious effect on soil, mycorrhizae, etc. A presowing treatment with this material might at least be helpful in supplementing the use of petroleum oil sprays that are somewhat hazardous to pine during early stages of growth.

Plots treated with allyl alcohol produced the largest number of seedlings, both total and plantable, of the tree species. For slash pine, this number represented almost 22 percent more plantable seedlings per square foot than were obtained from any other treated plots and over 30 percent more than from the untreated plots. Observations indicated that allyl alcohol had reduced early damping-off losses. Seedling stands were not increased significantly by the two fumigants that were most effective in root disease control. However, an evaluation of results with these and all other promising treatments must await further trials on rates and methods of application and data on survival of seedlings in field plantings.

TABLE II

Comparison of monocalcium arsenite with and without bordeaux and petroleum oil as eradicant treatment for controlling brownrot blossom blight in apricot trees.

Orchard no.	Treatment, pounds per 100 gallons or percent by volume*	Percent reduction in sporodochial development	Percent reduction in twig blight**
1	Monocalcium arsenite, 3-100	87	99
	Monocalcium arsenite, 3-100; plus bordeaux, 4-4-100; plus ½ percent petroleum oil	80	99
2	Monocalcium arsenite, 3-100	67	80
	Monocalcium arsenite, 3-100; plus bordeaux, 4-4-100; plus ½ percent petroleum oil	58	75
3	Monocalcium arsenite, 3-100	91	99

* All plots received bordeaux 10-10-100 at the pre-bloom stage.

** Compared with an average of 21 percent blossoming twig blight in eight orchards that received only bordeaux 10-10-100 at the pre-bloom stage.

Brown-Rot Fungus

IN 1942 E. E. Wilson of the University of California reported that a spray preparation containing 3 or 4 pounds of monocalcium arsenite per 100 gallons of water was very effective in suppressing the development of spores of *Monilinia laxa*, a cause of brown-rot blight in stone-fruit trees, in California. Bordeaux mixture 4–2–100 and 8–4–100 had little effect on the 4–100 monocalcium arsenite preparation but reduced the eradicative action of 1–100 and 2–100 preparations. Recent work in Wisconsin has indicated that 6–4–100 bordeaux and ⅜ percent menhaden fish oil increased the efficacy of monocalcium arsenite, and that ⅜ percent "stanolind" spray oil could be substituted for the fish oil.

These additions were tested under California conditions in 1949.

A heavy emulsifiable petroleum oil preparation ("Ortho-Adhesive") was substituted for the fish oil which was not available at the time of the tests. Bordeaux 4–4–100 was mixed in the sprayer tank, and 3 pounds per 100 gallons of monocalcium arsenite and ½ percent of the oil were added. In mid-January, 1949, this mixture, and a 3–100 preparation of monocalcium arsenite only, were applied to different blocks of apricot trees bearing numerous brown-rot-blighted twigs. In addition, these blocks received bordeaux 10–10–100 at the pre-blossom (red-bud) stage.

At the time of this eradicant treatment, very few sporodochia (clusters of spore-bearing fungus filaments) of the fungus were present on the blighted twigs. Large numbers developed during February, however. Evidently the action of the eradicant spray was primarily suppression of sporodochial development rather than destruction of sporodochia present at the time of treatment.

All apricot trees in the test orchards were given the eradicant treatment, so four nearby orchards which received only bordeaux 10–10–100 at the pre-blossom stage were utilized as checks or controls on the experiment. They were similar to the test orchards in abun-

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Boll Weevil Infestation Worst in Years

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Haeussler is in charge of Insect Pest Survey and Information, Agric. Research Adm., B. E. & P. Q., U.S.D.A. His observations are based on latest reports from collaborators in the department's country-wide pest surveys.

By G. J. Haeussler

THE boll weevil was more abundant and infestations more widespread during the last half of June and first half of July than during the same period in any years since 1941. Weather conditions during June were favorable for weevil development in all states east of Texas and Oklahoma. Hot, dry weather during early July plus the wide use of insecticides helped to improve the situation somewhat. However, weevils were occurring in large numbers farther north than usual, including Tennessee and northern parts of Georgia, Alabama, Mississippi, and Arkansas. The necessity of applying insecticidal control measures over such large areas of the south resulted in local shortages of insecticides for use by cotton growers in several states. Supplies of the newer materials made with benzene hexachloride, DDT, or toxaphene became increasingly tight. On July 15 the Bureau of Entomology and Plant Quarantine suggested that in areas where the boll weevil is the only pest to be controlled, cotton growers should use calcium arsenate, at least in alternate applications, in order to conserve supplies of the other materials for use when necessary to control insects for which calcium arsenate is not fully effective.

Serious outbreaks of the bollworm were reported toward the end of June in cotton fields of the Lower Rio Grande Valley of Texas and the Pecos Valley of New Mexico. Bollworms were also reported from most of the other cotton growing states, but there is some uncertainty as to the species. Lepidopterous larvae of several other species that attack the squares and bolls appear to be more abundant than the bollworm in some areas.

The first cotton leafworm was reported this year from Calhoun County, Texas, on July 18. Cotton leafworms were first reported last year in Refugio County on June 20, and in 1947 the first leafworms were collected in Nueces County on June 21. A report from Puerto Rico indicated that the cotton leafworm has been observed this year in some abundance at Isabela, and that this is the first record of the occurrence of this insect on the island since 1942.

Emergence of European corn borer moths was nearly complete by the end of June in all areas from which reports were received, except in Maine. Deposition of first generation eggs had passed the peak by mid July in all states other than Maine. The exceptionally large number of egg masses observed per 100 plants throughout most of the Corn Belt indicated the possibility that damaging borer populations may occur over large areas. Especially severe infestations are expected to occur in parts of Illinois and Iowa. By the middle of July pupation of first generation borers had been reported in several states and emergence of moths from these pupae had been observed in Maryland, New Jersey, and Ohio.

Grasshoppers Abundant

IN the major grasshopper outbreak area of Montana and Wyoming, more than 2 million acres of range land had been baited by the middle of July. Ranchers reported that in general excellent results were being obtained with bait spread by either ground or aerial equipment. However, the fact that hopper infestations were heavier than anticipated made it necessary to increase the application rate of the bait from 5 to 10 pounds per acre. Early in July, heavy grasshopper infestations on range lands in northwestern Nevada and southeastern Oregon were shaping into definite migratory bands with established directions. The movement was generally in a north-northwesterly direction and many bands of 'hoppers were moving from Nevada into Oregon.

Damage to range was most noticeable in areas where the migrations were slowed or halted temporarily by weather conditions or other factors.

In Texas, grasshoppers were becoming increasingly difficult to control during the first half of July as they matured and moved about continually. Many farmers in the northern east-central part of the state found it necessary to double or triple recommended dosages of chlordane or toxaphene in order to obtain good results. Many cotton growers using toxaphene or benzene hexachloride dusts to control cotton insects were at the same time securing good control of grasshoppers. Considerable grasshopper damage to corn, cotton, and alfalfa was reported from the Red River area of north-central Texas.

By July 9, more than 9,000 tons, (dry weight) of grasshopper bait had been applied in the cooperative federal-state grasshopper control program conducted in 17 western and mid-western states. In general, throughout crop areas farmers are purchasing large quantities of chlordane or toxaphene and are applying these materials as dusts or concentrated sprays to field margins, roadsides and similar areas in the vicinity of crops. Good control of grasshoppers is being reported following such applications.

Infestations of the codling moth continued light during late June and early July in all areas from which reports were received. Moths that developed from the first brood of larvae were emerging in many areas by the middle of July.

The red-banded leaf roller was reported to have caused more injury in several orchards examined during June in southern Indiana, western Kentucky, and western Tennessee than had been observed at that time of year in any of the previous 3 years. In the Vincennes district of southern Indiana lead arsenate residues from sprays that had been applied against larvae of the first brood held second brood of larvae in check and excellent control resulted. Serious damage to apples and cherries was reported in mid-June from southeastern New York. Light infestations of this insect were reported during the last half of June or first half of July from Massachusetts, Maryland, Virginia, Ohio, Illinois, Missouri, and Kansas.

European red mite infestations were reported from most fruit growing areas from Massachusetts to North Carolina and from Ohio, Indiana, Kentucky, Tennessee, Illinois, Wisconsin, Kansas, Missouri, and Washington. Populations were increasing rapidly in most areas during the first half of July, bronzing of foliage being reported in some instances. At the same time, two-spotted spider mite populations were also increasing rapidly in orchards of a number of states, including Massachusetts, New York, Indiana, Illinois, and Kansas.

Infestations of the Mexican bean beetle reached moderate to heavy intensity in the coastal regions from New York to Mississippi during late June and early July. They were, however, generally considered below normal in intensity for this time of year. This insect was also numerous during early July in northwestern Tennessee and some parts of southern Ohio. The potato leafhopper was reported causing injury to beans in localized areas of several states, including New York, New Jersey, Virginia, northwestern Tennessee, and Florida. Toward the middle of July the sugar-beet wireworm was seriously injuring beans in Ventura County, California, the bean thrips was also numerous on that crop in that section, and aphid populations were increasing on beans in western Washington.

Cabbage caterpillar infestations continued light to moderate on cole crops throughout the last half of June. In early July they increased somewhat in intensity and were characterized as moderate to heavy in parts of Maryland, Georgia, Florida, Tennessee, Ohio, Wisconsin, and Idaho. The cabbage maggot caused considerable injury during the last half of June in New York and North Carolina, and serious infestations of that pest occurred on radish in southern Idaho. Aphids on crucifers were generally present in light to moderate populations toward the middle of July, but the cabbage aphid and turnip aphid were causing serious damage to cabbage and rutabaga, respectively, in western Washington.

Flea beetles were infesting a wide range of vegetables during the last half of June in a number of states, including New York, Virginia, South Carolina, Georgia, Tennessee, and Utah. They were still causing considerable injury to eggplant in South Carolina during the early part of July.

The onion thrip was seriously abundant on onions in New York, New Jersey, and Wisconsin early in July, and was damaging cucumbers in southern California toward the middle of the month.

The potato psyllid was reported as unusually numerous on potato and tomato in parts of Nebraska, Wyoming, and Colorado during the last half of June, and toward the middle of July was said to be causing serious losses to these crops in those areas.

Pea aphid populations continued at relatively low levels in most areas. However, during the last half of June moderate to heavy infestations occurred in Wisconsin and populations were high on canning peas in Utah. By the middle of July this insect was no longer considered a problem for this season in most pea-growing areas. Insecticide applications were required to control the pea weevil in New York during the last half of June, and infestations of this insect were abundant and widespread in Utah during that period. Relatively light pea weevil populations apparently occurred in most other pea growing areas.

Reports received during the last half of June indicated that South Carolina, Georgia, and Florida were experiencing the heaviest infestations of aphids on tobacco since outbreaks of these pests first appeared on that crop in 1946.

Harvest of shade-grown tobacco was nearly completed in Florida by the end of that month. Insecticide applications were largely preventing serious losses to flue-cured tobacco in northern Florida. Reports from Georgia indicated that aphids were still present on flue-cured tobacco at the end of June but that the extent of damage cannot be determined until curing and grading of the crop is completed. The aphid infestations on tobacco in South Carolina and also those in Tennessee decreased rapidly during early July.

Aphids were found on young tobacco in Connecticut during the last week of June. Populations increased during early July but had not reached destructive numbers by the middle of that month. In Massachusetts aphids were found on sun-grown tobacco in many fields during the first half of July and growers of shade-grown tobacco were applying insecticides for aphid control. A light but well distributed aphid population on tobacco was reported from southern Wisconsin toward the middle of July.

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DDT Harmful to Chicks?

Kentucky Agricultural Experiment Station, Lexington, Ky., reports one occurrence of poisoning in young fowl, eight weeks old, following heavy spraying of a brooder house with wettable DDT. Losses began seven days following application of the spray. Symptoms consisted primarily of cyanosis, paralysis and convulsive movements. Similar occurrence, a brief report on the incident says, could be prevented "by reasonable application of the spray on walls and avoiding contamination of the litter."

Missouri Agricultural Experiment Station, Columbia, Mo., reports that, in an investigation of DDT toxicity to poultry, day-old chicks safely tolerated DDT in the diet in amounts less than 5 parts per 10,000 parts of feed. Death resulted when feed contained 10 parts or more per 10,000 parts of feed. Chicks receiving less than a lethal dose of DDT apparently recovered fully. The study, it is pointed out in the station's annual report, "shows that DDT in the water wettable spray or dust form may be safely used around poultry as an insecticide if normal precautions and safeguards are used."

Insecticide Shortage Plagues Trade

HEAVY infestations of cotton insect pests in the South, grasshoppers and corn borers in the Mid-west, and other insect outbreaks such as army worm and salt marsh caterpillar in other localities have brought the heaviest demand for insecticides during the past two months which has been noted in several years. Spot shortages of a number of insecticidal materials have developed all over the country. Manufacturers of basic chemicals, DDT, BHC, toxaphene, chlordane, and others, as well as the formulators have found stocks seriously depleted or completely cleaned out. The scarcity is expected to last through August, according to present indications, although DDT and chlordane are now more freely available than they were a month ago.

Especially for toxaphene and BHC formulations, recent inquiries for large quantities have been uniformly turned down by suppliers. Manufacturers state that all of these materials in process have been allocated for shipment for several weeks past and they have been unable to take on new business, which has aggravated spot scarcities further. Although producers of toxaphene and BHC are reported pushing production and planning for expanded output, the latter will be chiefly for the 1950 market and will not be available this year.

Fears of government bans against DDT and other chlorinated insecticides early this year are in part responsible for the hesitancy of local dealers and compounders to stock up several months ago. The frantic demand which developed starting in June accordingly caught many local firms with insufficient stocks. Some formulators report that their plants have been running "around the clock" for the past eight weeks and that there had been no let-up as of August 1.

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Florida Prints Proceedings

Proceedings of the sixty-first annual meeting of the Florida State Horticultural Society have been pulished by the society. The book is divided into four main sections: citrus, vegetable, processing and ornamental, with other departments of the book devoted to annual reports and to articles by members of the Krome Memorial Institute.

Among the reports in the citrus section was one by Hubert Spencer and Max R. Osburn, U.S.D.A., Fort Pierce, Fla., who describe their experiments in control of citrus red mite. Various combinations with wettable sulfur were tried, with best results being obtained by use of dinitro-ortho-cyclohexylphenol and wettable sulfur. However, when temperatures were high, spray burn may result, the authors warn. "Xanthone" and parathion, with wettable sulfur, controlled mites "reasonably well", they report.

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Horticultural Book Published

The Western Colorado Horticultural Society has published the proceedings of its sixth annual convention which was held at Mesa College, Grand Junction, Colo. in January. The 230 page book contains a record of the complete program including various symposia as well as the text of prepared papers.

Officers of the society include, P. W. Eames, president; Oscar Jaynes, first vice-president; F. C. Carlson, second vice-president; and J. R. Younger, secretary-treasurer.

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Technical Briefs

Milk Contamination by DDT

DDT limitations in dairy fly control, and a report on further investigations of DDT resistant houseflies were discussed by E. F. Knipling, B.E.P.Q., U. S. Department of Agriculture, at the June 13, 1949 meeting of the National Association of Insecticide & Disinfectant Manufacturers in Chicago. The following is a summary of the paper.

The use of DDT for fly control on milk cows and in dairy barns has been banned by the U.S.D.A. because of evidence that such use contaminates the milk. Investigations of the means by which DDT might be introduced into the milk in the course of such treatment have suggested the following three possible avenues of contamination: (1) by direct contamination of the feed, feed troughs or watering cups; (2) by ingestion of the chemical through the cows breathing the air borne vapors; and (3) by contamination of the milk or milking utensils with the chemical from the hands or clothing of the operator, by settling off DDT particles which might be air borne due to wind currents, or by flaking off from the walls and ceilings.

Investigations of these possible sources of contamination indicated: that direct contamination of feeding troughs, etc., may result unless proper precautions are taken during spraying. The feed troughs, stanchions and walls nearby should be completely covered during the spraying operation or cleaned after spraying. The second possible source was eliminated as a probable means of milk contamination. There is no information, at the present time, as to the importance of contamination by the third possible avenue.

Studies have been conducted to determine whether the DDT resistant strains of house flies will lose their resistance when they are not subjected to further DDT treatment. "Results of these investigations indicate that there is a tendency for the flies to lose their resistance when they are no longer exposed. However, the extent of the loss in resistance is extremely variable in different colonies and most of the flies show some resistance to DDT after as many as six generations without exposure to DDT".

Investigations on the effect of other insecticides on DDT resistant flies indicate that "practically all strains of flies showing high resistance to DDT also show some resistance to other insecticides, especially to methoxychlor."

Potatoes tested for Flavor

Palatability tests were conducted on the presence of an off-flavor in cooked potatoes grown in soil treated with either benzene hexachloride, chlordane, or chlorinated camphene for the control of wireworm.

In the case of benzene hexachloride, the intensity of the flavor increased with the dosage of insecticide and was detected even at the minimum level tested of 1 pound per acre. The flavor was particularly objectionable. Although inconclusive, the evidence suggests that potatoes grown in soil treated in the preceding year carried the same flavor. Apparently the pure gamma isomer of benzene hexachloride also imparted a foreign flavor to potatoes but the flavor was less objectionable than with the crude form.

Tests with potatoes grown in chlordane-treated soil were inconclusive but any resulting flavor from chlordane was much less objectionable than the flavor of benzene hexachloride.—Mary L. Greenwood, Storrs Agricultural Experiment Station and Jean Marie Tice, School of Home Economics, University of Connecticut, in *Journal of Agricultural Research*, Vol. 78, No. 11, June 1, 1949.

How Insecticides Work Against Pests

"THE Mode of Action of Organic Insecticides" by R. L. Metcalf, is the first of a series of reviews published by the National Research Council. This review contains 77 pages of text followed by a list of about 300 references. Copies are available at $1.00 each. The text has been organized into nine chapters, each dealing with a recognized insecticide or class of insecticides. Each chapter is introduced by a brief review of the chemistry of the compound concerned and the relation of the chemical structure to toxicity, followed by toxicological, physiological and biochemical discussions of the material. Because of lack of data on the properties and modes of action, some of the more interesting insecticides such as chlordane, chlorinated camphene, xanthene and tartar emetic have been left out of the text. The following are the insecticides covered in the review:

Nicotine—Aside from nicotine, only the anabasine and nornicotine derivatives of tobacco are of any importance from the insecticidal viewpoint. The toxicity of these three compounds to several species of insects is compared. Free nicotine is more toxic than ionized nicotine in solution. Nicotine is only moderately toxic to most insects as compared with the newer organic insecticides.

Pyrethrum—The pyrethrins are unique among insecticides in the rapidity with which they paralyze insects. A study of the relative toxicity of pyrethrins I and II indicates I to be the more effective in certain concentrations and solutions. Tabular data of the toxicity

(Turn to page 54)

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of the components of pyrethrum are presented. Pyrethrum is considered strictly as a contact insecticide, since it has little stomach poison action.

Rotenone—Rotenone and rotenoids decrease in toxicity when exposed to air. Theories of toxic action attribute toxicity (1) to the presence of the toxaphoric grouping —CO—C—C—O—L, and (2) to the hydrogen atoms of the control ring on carbons 7 and 8.

Rotenone can act either as a contact or stomach poison. It is about equal in effectiveness when dusted on the insects' bodies or when it is applied as a surface residue. It produces no specific effects on the motor nerves and the attached muscles of insects.

Organic Thiocyanates—Available data on the relative toxicities of a homologous series of compounds such as the aliphatic thiocyanates indicate that a maximum toxicity is reached by increasing the chain length; beyond this point, the toxicity decreases with further elongation of the chain. Investigations indicate that the high rate of knockdown of the thiocyanoacetates and the thiocyanoketones may be due to action on an enzyme system having particular affinity for the —COCH$_2$SCN.

Dinitrophenols—The dinitrophenols are highly toxic as contact poisons, stomach poisons, and ovicides to a variety of insects. Tabular data of the relative toxicities of some nitrated phenols to insects is presented. The insecticidal effectiveness of the nitro phenols is found to increase with increasing chain length up to maximum at n-hexyl and n-heptyl, and then decreases.

Phenothiazine—Oxidation of films of phenothiazine in air and light could largely be prevented by the presence of an antioxidant. Insecticidal effectiveness of phenothiazine, phenothiazone and thionol vary with different insects. Although classed as an organic stomach poison, phenothiazine often acts as a contact poison.

Dichlorodiphenyltrichloroethane—Relative toxicities of degradation products of p-p'-DDT, and analogues of DDT are tabulated. Studies indicate that the nature of the nuclear (ring) substituent affects the toxicity of the compound. The primary site of DDT action is centered on the sensory peripheral nervous system.

Theories of the mode of toxic action, entrance into the insect body, physiologic experiments and data are included in the 17 pages dealing with this compound.

Benzene Hexachloride—Structural formulas of the isomers of hexacyclohexane are difficult to determine because of the uncertainty of the form of the basic cyclohexane ring. Tabular data of the relative toxicities of the isomers and related materials to insects are presented. Measurements of the dipole moments indicate a relationship between the dipole moment and insecticidal activity which is greatest for aromatic compounds having moments of the order of 4D.

Organic Phosphates—Tetraethyl pyrophosphate is the active insecticidal ingredient of the hexaethyl tetraphosphate mixtures. Tabular data is presented for the relation of chemical structure to toxicity, followed by discussions of toxicology, biochemistry, etc.

Experiment Station Bulletins

Dutch Elm Disease Booklet

Connecticut Agricultural Experiment Station, New Haven, has published bulletin #531, "An Evaluation of Chemotherapy and Vector Control by Insecticides for Combatting Dutch Elm Disease". Authors are A. E. Dimond, G. H. Plumb, E. M. Stoddard and J. G. Horsfall.

The bulletin reviews the theory underlying the selection of chemotherapeutants, discusses the principles of field chemotherapy and reports the results of spray experiments for control of *Scolytus multistriatus* Marsh. One section is devoted to a study of the value of combining chemotherapy and vector control by DDT.

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Ag. School Catalog Issued

Long Island Agricultural and Technical Institute, Farmingdale, L. I., New York, has issued its 1949 catalog for courses in agriculture and ornamental horticulture. The book presents the various curricula available for courses in general agriculture, animal husbandry, dairy industry, fruit production, vegetable production, poultry husbandry, agricultural engineering, agricultural business, field and laboratory investigation techniques, and frozen foods.

Complete information on entrance requirements, fees and anticipated expenses, housing facilities, and a description of the school and campus are included in the catalog. Copies are available from the school.

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Insecticide Review

"New Insecticides; Their Use, Limitations and Hazard to Human Health," is the name of a new 17-page bulletin recently published by the Washington State Agricultural College, Pullman, Washington. The bulletin is designated as Station Circular No. 64. It lists the newer insecticides one by one, giving the history and many of the uses of each. Copies of the bulletin are available.

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Wireworm Control Discussed

Farm Research, quarterly publication of the New York State Agricultural Stations, Geneva and Ithaca, carries a lead article on "What's New in Wireworm Control" in its June issue. The article, written by Alice M. Briant, W. A.

(*Turn to page 75*)

Suppliers' Bulletins

New Talc by Vanderbilt

R. T. Vanderbilt Co. has recently introduced "Nytal 300," a sterile talc of unusually fine particle size produced by a new process at the Gouverneur Talc Co., Balmat, N. Y. In the new process, the ore is first dried and then air-drilled at high temperatures and pressures. The action of the talc particles against themselves in this process is said to break particle size down to a fineness not obtained by conventional methods. The new product has a specification of only a trace retained on a 325 mesh screen, and its average particle size is about 1.8 microns by air permeation, the company states.

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Wood Preservative

Development of a new wood preserving material, copperized chromated zinc chloride, was announced recently by Koppers Company, Inc., and E. I. duPont de Nemours & Co., Inc. whose joint research had resulted in the discovery.

The new preservative, containing 73 percent zinc chloride, 20 percent sodium dichromate and 7 percent cupric chloride, has proved in pilot plant treatments to be similar in handling, treating, and control of the solution equilibrium to chromated zinc chloride and other salt preservatives containing more than one type of toxic ion.

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Toxaphene Bulletin Offered

Dusts and sprays based on toxaphene are the first to give good control of the salt-marsh caterpillar, according to a new four-page leaflet about the use of toxaphene, now available from Hercules Powder Company, Wilmington, Del.

According to a U.S.D.A. report dust mixtures containing 15% toxaphene and 5% DDT were used against the salt-marsh caterpillar on cotton in Arizona when a major outbreak occurred there. Thousands of dead caterpillars were found in the treated areas. Until the advent of toxaphene, no control method that was entirely satisfactory had been found.

Included in the booklet are explanations of how to use toxaphene, how much to use, and other pertinent information.

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New Mist Blower Announced

Production of a new air-type concentrate mist sprayer has been announced by the Hardie Mfg. Co.

The new unit is said to save a fourth of spray material and seven-eighths of the water haul. It is operated by one man, and is described as being capable of giving complete coverage with or against the wind and in the rain.

The makers say that it is possible to spray 100 to 300 trees in 30 to 40 minutes from a 300 gallon tank. The spray is directed up from the underside of the tree along the limbs, turning the leaves and securing uniform coverage of both sides of leaves and on the fruit. Air delivery of the machine is approximately 20,000 cubic feet per minute at 110 mph. The angle of the air stream may be adjusted to compensate for wind interference. Write to Hardie Mfg. Co., Hudson, Mich., for literature.

•

Goodrich Offers New Reactants

B. F. Goodrich Chemical Co., Cleveland, Ohio, has announced the availability of Beta-Chloropropionic acid and Beta-Mercaptopropionic acid in experimental quantities. The former acid undergoes the usual reactions of carboxylic acids such as esterification, amide formulation and salt formation in addition to the reactions possible with the active chlorine. It is available as a white crystalline water soluble solid, melting at 36–39° C.

Beta-Mercaptopropionic acid reacts both as a carboxylic acid and as a mercaptan. It has a purity of about 99 percent, and is available as a water soluble liquid distilling at 114–115.5° C *@* 13 mm. Write for literature from Goodrich Chemical Co., Rose Building, Cleveland, Ohio.

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Dow Herbicide Pamphlet

Dow Chemical Co., Midland, Michigan, has published a new agricultural chemical pamphlet entitled "Dow Sodium TCA 70%", which is available to the trade.

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Inert Packing Described

"Packing for the Chemical Industry," a new booklet designed to present a complete picture of packing requirements for many chemical applications, is available from the Crane Packing Company, 1800 Cuyler Ave., Chicago 13, Illinois. A special feature of the booklet is devoted to "Chemlon," chemically inert packings developed by Crane.

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Weed Killer Bulletin

F. H. Peavey & Co., Minneapolis 15, Minn., has recently issued a report of a survey conducted by the company on chemical weed control. The bulletin lists a number of questions formerly asked by users of herbicides, and answers them from current data.

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INDUSTRY NEWS

Lerch New NAC Editor

The National Agricultural Chemicals Association, Washington, D.C., has announced that Don Lerch, formerly Director of Agricultural Broadcasts for the Columbia network, has become editor of the N.A.C. *News*, and will be in charge of publicity and public relations for the Association.

DONALD G. LERCH, JR.

Mr. Lerch, well known to the trade not only through his program, "Country Journal", but also from his attendance at numerous meetings, is a graduate of Pennsylvania State College with a degree in agronomy. Following his graduation in 1940, he became a soil specialist for the American Agricultural Chemical Co., and later joined radio station KDKA, Pittsburgh, as agricultural director.

During most of the war years he was affiliated with the U.S.D.A., serving both as a specialist in Washington and at another time as public relations chief in the Department's New York office. Following the war, and for a year before his connection with CBS, Mr. Lerch was agricultural director for Station WEAF in New York.

He is a native of Pittsburgh, Pa., is married and has two daughters. He will continue to make his home in Washington.

AAEE Plans Big Meeting

Plans for the joint meeting of the American Association of Economic Entomologists and the Entomological Society of America to be held in Tampa, Florida, December 13–16, are getting under way, according to John T. Creighton, chairman of the convention committee on arrangements. In additon to the two national organizations, four other groups will be represented at the meeting. These are the Newell Entomological Society; the Cotton States Branch of the A.A.E.E.; the Florida Entomological Society and the Florida Pest Control Association.

Headquarters for the A.A.E.E. and the Cotton States Branch will be the Tampa Terrace Hotel. The Entomological Society of America and the Florida Entomological Society will maintain headquarters at the Hillsboro Hotel.

Room reservations are being made through A. K. Dickinson, Director, Convention and Tourist Bureau, Tampa Chamber of Commerce, P.O. Box 420, Tampa, Fla. Ample accomodations will be available for all who wish to attend, Mr. Creighton says.

MEETINGS

National Shade Tree Conference, Hotel Lord Baltimore, Baltimore, Md., August 23–26

Centennial Symposia on Plant Nutrition. University of Wisconsin, Madison, September 1–7, 1949.

American Phytopathological Society, northeastern division's 1949 summer meeting (tour) beginning at New Brunswick, N. J., September 8, continuing two days. (Write E. G. Rex, P.O. Box 1, Trenton, N. J.)

National Agricultural Chemicals Association, Essex & Sussex Hotel, Spring Lake, N. J., September 7–9, 1949.

American Association of Feed Control Officials, Shoreham Hotel, Washington, D. C., October 5.

Association of Economic Poisons Control Officials, Shoreham Hotel, Washington, D. C., October 8.

Association of Official Agricultural Chemists, Shoreham Hotel, Washington, D. C., October 10–12.

National Pest Control Association, Biltmore Hotel, Los Angeles, Calif., October 17–19.

American Society of Agronomy, Milwaukee, Wisconsin, October 24–28, 1949.

California Fertilizer Association, 26th Annual Convention, Palace Hotel, San Francisco, Calif. November 7, 8, 9, 1949.

North Central Weed Control Conference, Sioux Falls, S. D., Dec. 6, 7, 8, 1949.

American Association of Economic Entomologists, 61st Annual Meeting, Tampa, Florida, December 13, 14, 15, 16, 1949.

American Phytopathological Society, Martinique Hotel, New York, December 28, 29 & 30. (In conjunction with American Association for Advancement of Science)

Northeastern States Weed Control Conference, Hotel New Yorker, New York, January 3–5, 1950.

Law Revisions Issued

Revision in state and federal economic poison laws covering insecticides, fungicides, disinfectants, rodenticides, herbicides and allied products for 1948–1949 have been issued as a printed supplement to its Compilation of Economic Poison Laws by the National Association of Insecticide & Disinfectant Manufacturers, New York. The printed revisions which include all new laws and regulations are in loose leaf form intended for inclusion in the original binding.

The revisions include forty pages of new regulations under the new U. S. Insecticide, Fungicide and Rodenticide Law. The law changes and regulations cover fourteen states, Hawaii and Canada. A new chart showing the labeling and registration requirements of all states at a glance is also included.

Author of the revisions, as of the original Compilation, is John D. Conner, Washington attorney and NAIDM general counsel.

N.E. Weed Meeting in Jan.

The fourth annual meeting of the Northeastern Weed Control Conference will be held at the Hotel New Yorker, New York, January 3, 4, and 5, 1950, it has been announced by Dale E. Wolf, secretary of the group. The program is in conjunction with meetings of the Empire State Potato Club and the New York State Vegetable Growers Association which are to be held January 5 and 6.

The tentative program calls for one day of general papers, one day of individual papers in each of the 3 sections, namely, Agronomy or Farm Crops, Horticultural Crops, and Health and Welfare. On January 5th a meeting of those interested in research is planned to bring what information has been presented together and to determine what future research is needed.

A trade show similar to the one of last year will be held again. Dr. G. H. Ahlgren, New Jersey Agricultural Experiment Station, New Brunswick, New Jersey, is chairman of this committee. The Trade Show is also to be a cooperative arrangement with the Potato and Vegetable organizations, exhibitors having the opportunity of showing before all 3 groups.

Dr. A. E. Prince, Agricultural Experiment Station, University of Maine, Orono, Maine, has requested that the deadline for receiving titles of proposed papers be November 1 and that the deadline for receiving stencils of the papers be November 15. All titles of papers to be presented should be forwarded directly to Dr. Prince.

•

A.O.A.C. Meets in October

The annual meeting of the Association of Official Agricultural Chemists will be held October 10, 11 and 12 at the Shoreham Hotel, Washington, D. C. Henry A. Lepper, secretary-treasurer of the group stated that programs are expected to be ready for distribution early in September, but that details of the meeting had not been completed as *Agricultural Chemicals* went to press for the August issue.

•

Va.-Carolina Bag Plant Opens

Virginia-Carolina Chemical Corporation, Richmond, Va., has opened a new textile and paper bag factory in Atlanta, Georgia. The new plant, which will manufacture multiwall paper sacks and burlap and cotton bags, is under the direction of D. Harold Johnson, manager of the Bag Division of the corporation, with headquarters in Richmond, Virginia. Ernest R. Lacy, formerly of Richmond, has been appointed Southeastern District Manager, with headquarters in Atlanta, and Harold R. Stemple is superintendent in charge of plant operations.

V-C textile bags have been manufactured in Richmond, Virginia, since 1899.

NEWS *from the* VANDERBILT LABORATORIES

Recent tests indicate that very small amounts of DARVAN dispersing agents actually increase the effectiveness of the toxicant in typical wettable concentrates. This characteristic is in addition to the DARVAN properties of producing better dispersibility and ease of suspension. General results may be summarized by the fact that field tests showed *greater crop yields* when DARVAN was added to the active agent and carrier than when the same carrier and agent were used without DARVAN. The addition of DARVAN with a wetting agent also increased the yield, while the addition of a wetting agent without DARVAN decreased the yield.

Information on these and other characteristics of DARVAN may be obtained by writing Specialties Dept., R. T. Vanderbilt Co.

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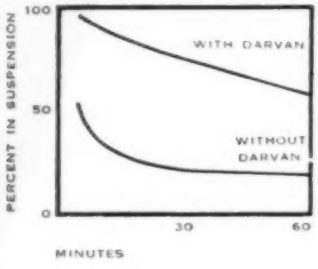

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Carter Heads Hawaiian Study

Dr. Walter Carter has been appointed by the U. S. Department of Agriculture as organizer and director of investigations toward control of the oriental fruit fly in Hawaii. The announcement was made by Dr. P. N. Annand, chief, bureau of Entomology and Plant Quarantine, U.S.D.A.

Dr. Walter Carter

Dr. Carter's plan of research will be divided into five parts: study of insect habits; treatment of infested agricultural products; a search for insecticides to control the pest; launching of large-scale control and eradication studies to form a background for action in case the oriental fruit fly should appear on the U. S. mainland; and a study of natural control.

Cooperating with the Bureau of Entomology and Plant Quarantine will be the Hawaiian and California Agricultural Experiment Stations, the Hawaiian Board of Agriculture and Forestry, the Pineapple Research Institute and the Experiment Station of the Hawaiian Sugar Planters' Association.

The oriental fruit fly is regarded as a serious and destructive insect pest in the South Pacific. It was only recently found in the Hawaiian Islands, and if introduced into the U. S., entomologists fear that it would be highly destructive to agriculture, particularly the fruit-growing industry. All fleshy above-ground fruits and vegetables are considered as potential hosts.

Shade Tree Conference in Aug.

A four-day convention beginning August 23 is planned by the National Shade Tree Conference in observance of the group's 25th anniversary. Locale of the meeting is the Hotel Lord Baltimore, Baltimore, Md.

Pre-convention plans called for papers to be presented in a number of agricultural chemical subjects, including "Fertilizer Applications by Foliage Sprays", by Dr. Damon Boynton, Cornell University; "Trace Elements and their Role in Plant Nutrition," by Dr. H. L. Crane, U.S.D.A., Beltsville, Md.; "Boxwood Nematode Control," by Dr. Gotthold Steiner, U.S.D.A., Beltsville, Md.; "Control of Some Troublesome Insects," by Dr. Ernest N. Cory, University of Maryland; as well as a symposium which includes discussion on pest control in shade trees.

President of the National Shade Tree Conference is Norman Armstrong. Secretary-treasurer is L. C. Chadwick, Ohio State University, Columbus. Last year's meeting was held in Milwaukee, Wisconsin.

•

Maneely Names Dougherty Sec.

Maneely Chemical Co., Philadelphia, has announced the appointment of Henry J. Dougherty as secretary of the company. Mr. Dougherty has been since 1942, head of the Real Estate Division of an affiliated company, the John Maneely Co.

•

Gamma Rays for Disease Control?

Connecticut Agricultural Experiment Station, New Haven, has signed a contract with the Atomic Energy Commission to study the internal control of plant diseases. The agreement gives the Station funds for conducting experiments with radioactive materials as part of its research program in chemotherapy and physical therapy. Work outlined in the contract is aimed particularly at Dutch elm disease.

Brookhaven National Laboratory, Upton, Long Island, is furnishing space and facilities for part of the experiments. A field plot with a source of radiation rich in gamma rays in the center, is being used.

•

N.S.D.A. Elect Leiter

C. D. Leiter

C. D. Leiter, general manager of sales for the F. E. Myers & Bro. Co., Ashland, Ohio, was elected president of the National Sprayer and Duster Association at the group's 4th annual meeting July 14 & 15, in Chicago. He succeeds R. C. Hudson, president of the H. D. Hudson Mfg. Co., Chicago.

Other officers named at the meeting included Ralph B. Chapin, vice-president; D. P. Lewis, treasurer; and Frank J. Zink and Earl D. Anderson were re-elected respectively as counsel and secretary. Mr. Chapin is president of the R. E. Chapin Mfg. Works, Inc., Batavia, N. Y.; Mr. Lewis is with the H. D. Hudson Co., and Messrs. Zink and Anderson are with the Frank J. Zink Associates, Chicago.

The Association approved an expanded budget to increase cooperation with federal, state and other research agencies and chemical manufacturers in the interest of improving application equipment and developing new fields of use. Also included in the plans for the future is a program of consumer education to assist the public in the selection, use and care of equipment.

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Dr. Ball Joins Rutgers Staff

Dr. Charles O. Ball has been appointed professor and research specialist in food technology at the New Jersey Agricultural Experiment Station, Rutgers University, New Brunswick, it has been announced. Dr. Ball's appointment became effective on August 1.

•

Frost Joins Mathieson

Charles W. Frost, formerly vice-president of Prior Chemical Corp., New York, has joined Mathieson Chemical Corp., New York. Mr. Frost was with Union Carbide & Carbon Corp. before joining Prior in 1930.

•

Mich. Chem. in Export Shift

Michigan Chemical Corp., Saint Louis, Michigan, has announced that Philip J. LoBue who operates in New York the company which bears his name, has combined his staff with that of Michigan Chemical Corp., 230 Park Ave., New York, and will be responsible for the domestic sale in the east, of the company's "Pestmaster" line of DDT insecticides. Mr. LoBue will also handle the firm's line of pharmaceutical chemicals.

Other personnel changes were announced by R. A. Bondurant, Jr., Michigan Chemical executive vice-president and general manager, as follows: L. W. Gopp will be in charge of direct export sales for Michigan Chemical, and will cooperate with Mr. LoBue on export sales through domestic exporters. H. T. Hillard will act as office manager and will expedite and coordinate eastern domestic and export activites with the Michigan plant in Saint Louis.

•

Business Bureau OK's DDT

The National Better Business Bureau, Inc., New York, has issued a recent statement that "there is no reason why properly labeled household insecticides containing DDT should not be advertised and sold to the public". A. E. Backman N.B.B.B. editor comments, "it is well recognized that DDT, like other insecticides, is a poison and if sprayed on food or cooking utensils or otherwise used foolishly, can cause harm." He continues, however, by reminding that all DDT insecticides must be registered with the U.S.D.A., and reports that in an interview with "principal government agencies concerned with the use of DDT", all of these interviewed stated that there is no reason why properly labeled household insecticides containing DDT should not be advertised and sold to the public, if such advertising is truthful and informative. It was also pointed out, of course, that such advertising should contain cautions to use the material only as directed.

Those contacted by the N.B.B.B. included Ass't. Surgeon General J. W. Mountin, U.S. Public Health Service; Dr. W. G. Reed, Insecticide Division, U.S. Department of Agriculture; and Dr. S. A. Rohwer, Ass't. Chief, Bureau of Entomology and Plant Quarantine U.S.D.A.

•

Wallace to Goodyear Chem.

Roy Wallace, Cuyahoga Falls, O., has been named to a technical service post in the Chemical Division of the Goodyear Tire & Rubber Co., it has been announced. Mr. Wallace, a chemical engineer, will supervise test installations and applications of the firm's chemical products and will assist in the preparation of technical literature.

Garden Institute Moves

The National Garden Institute has moved its headquarters from New York to Chicago, it has been announced.

•

Lunsford to Pittsburgh Ag.

Pittsburgh Agricultural Chemical Co., New York, has announced the appointment of Charles F. Lunsford as company representative in charge of sales on the West

Charles F. Lunsford

Coast. Mr. Lunsford will maintain an office in suite 1204, Russ Building, San Francisco, Calif.

•

PCO Course at Purdue

Purdue University is offering a four year course in Pest Control operation. In addition to the science subjects including general biology and entomology, physics and chemistry, the course also provides work in business law, accounting, business writing and business interview.

The beginning of this project was in 1946, but by 1948 a new teaching position was created and John V. Osmun was appointed to conduct the seven new courses to be given in the Junior and Senior years. The University also allocated $2,500 for a special laboratory in this connection.

Complete details regarding tuition, entrance requirements, housing and other information may be obtained from Dr. J. J. Davis, Dept. of Entomology, Purdue Univ., Lafayette, Ind.

SULPHUR

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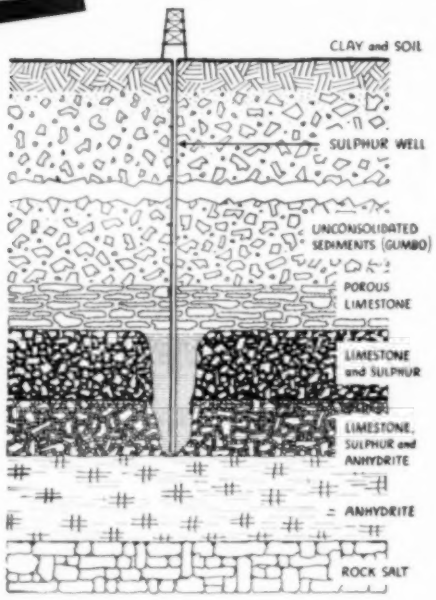
Practically all of the elemental sulphur used in this country comes from mines in Louisiana and Texas.

There, the sulphur deposits occur in the cap rock overlying certain salt domes. The sulphur is mined at depths of 300 to 2,000 feet below the surface. It is melted in place by pumping into the deposit water heated under pressure to a temperature above the melting point of sulphur. The melted sulphur flows away from the limestone and is pumped to the surface where it is allowed to solidify in vats. By such means sulphur nearly 100% pure is produced.



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NAC Ass'n Plans "Hot" Meeting

Because the annual fall meeting of the National Agricultural Chemicals Association is to deal with topics of immediate importance at convention time, September 7, 8 and 9, the Association had not issued an advance program as *Agricultural Chemicals* went to press for the August issue.

Lea S. Hitchner, executive secretary-treasurer of the group, said that a tentative schedule is being worked out for the meeting, but due to the "hot" nature of the gathering, it would be impossible to make any definite announcement until the latest possible date before the meeting began.

This year's convention as is customary, will be held at the Essex and Sussex Hotel, Spring Lake, New Jersey.

Tomato Hornworm Control

Featuring an article on tomato hornworm and its control, the Rohm & Haas *Reporter* for June, 1949 describes the pest with a number of good illustrations and discusses methods of its control. Particular emphasis is laid on control by the company's product, "Rhothane" (DDD), including information on drift and residue hazards.

•

Control Officials Meet in Oct.

October 8, 1949 is the date chosen for the third annual meeting of the Association of Economic Poisons Control Officials, at the Shoreham Hotel, Washington, D. C. According to Dr. A. B. Heagy, University of Maryland, College Park, Md., secretary of the group, the tentative program calls for talks by Dr. H. J. Hoffmann, St. Paul, Minn., A.E.P.C.O. president; Dr. P. B. Dunbar, commissioner, Federal Food and Drug Administration; Dr. Charles H. Mahoney, director, National Canners' Association; Lea S. Hitchner, executive secretary, National Agricultural Chemicals Association; and a representative of the N.A.I.D.M.

Both the speaking session in the morning and the afternoon meeting on committee reports will be open to industry representatives, Dr. Heagy reports. Industry representatives are also invited to attend a meeting of the States Relation Committee on Friday evening, Oct. 7, the evening preceding the formal gathering.

•

Arthur Rinke Dies

Arthur W. Rinke, attorney for the National Agricultural Chemicals Association (formerly A.I.F.), died July 31 at his home in Old Greenwich, Conn. He was 64 years of age. For many years he was counsel for John Powell & Co., New York, and was a brother of George R. (Bill) Rinke, of John Powell & Co.

The deceased was a native of New York, and a graduate of both Yale and Columbia Universities. His law practice began early this century with the Central Railroad of New Jersey and later shifted to the Petroleum Conversion Corp. and John Powell & Co.

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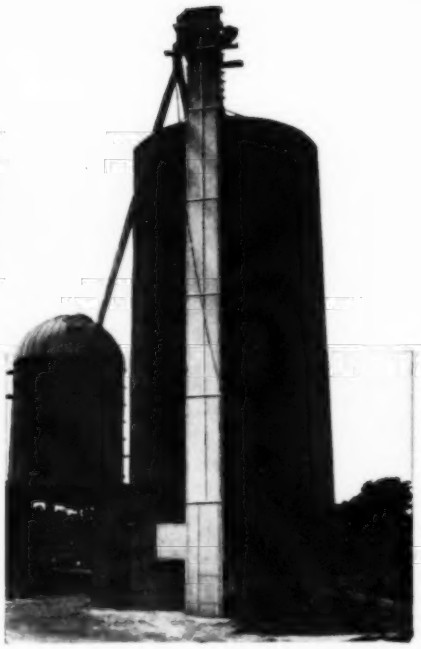

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Fertilizer News

Canadian Group Elects

The Association of Plant Food Producers, Ontario, elected the following officers for 1949–50 at the group's recent meeting at the Manoir Richelieu, Murray Bay, Quebec: Chairman, E. R. Olsen; vice-chairman, R. H. Stone; secretary-treasurer, A. Mooney; director, D. S. Aitken. Mr. Olsen succeeds E. M. Grose, who was chairman for the 1948–49 fiscal year.

Reports from the meeting speak of it as being a "real success", with 119 registered. Most of the party boarded the S.S. *Tadoussac* at Montreal and journeyed to Murray Bay, and made the return trip on the same ship following the convention. The meeting was held from June 28–30.

•

Storage Building in Ill.

Smith-Douglass Co. has begun construction on an all-steel fertilizer storage building at its plant at Streator, Illinois. The new building, parallel to another storage house, will be 100 by 200 feet in size, with a concrete floor. The building was expected to be ready for use by September 1.

•

Fertilizer Export Quotas Set

The U. S. Department of Commerce has announced an export quota of 52,000 tons (nitrogen content) of nitrogenous fertilizers for the 1949-50 fiscal year which began July 1.

The new quota is not only 10,000 tons less than that of last year, but is to operate on a "purely voluntary" basis. It permits exporters to ship up to 52,000 tons, but does not require them to meet this figure. No priorities will be used requiring exporters to meet foreign demand.

The department plans to review about October 1 its tentative quotas for Latin America, the Philippines and India, whose present quotas were not revealed. There is some question whether the other countries tentatively covered in the undistributed reserve portion of the quota will want U. S. material in view of the improvement in world supply of nitrogen. The 10,000-ton reduction from last year's export quota was said to reflect the recent increases in nitrogenous fertilizer production in some foreign countries.

•

Agronomists Elect Buckman

The 1949 summer meeting of the Northeastern Branch of the American Society of Agronomy was held June 26–29, with the Universities of Rhode Island and Connecticut as hosts. H. O. Buckman, Cornell University, was elected president of the Branch. Other officers elected included W. C. Libby, U. of Maine, vice-president; S. R. Aldrich, Cornell, secretary-treasurer; and A. R. Midgley, U. of Vermont, councilor for the National Society.

Lack of space in the July issue prevented our publishing this list of prize donors with the report of the American Plant Food Council meeting. In alphabetical order, the donors were:

Agricultural Chemicals Magazine
American Plant Food Council
American Cyanamid Co.
Chilean Nitrate Sales Corp.
Cooperative Fertilizer Service
Ellis Chemical Co.
Federal Chemical Co.
GLF Soil-Building Service
Mathieson Chemical Corp.
Michigan Fertilizer Co.
Potash Company of America
F. S. Royster Guano Co.
Southern Fertilizer & Chemical Co.
Sturtevant Milling Co.
U. S. Potash Co.
Wilson & Toomer Fertilizer Co.

A tour of the experimental farms was made under the direction of Dr. T. E. Odland, Rhode Island and Prof. A. B. Brown, Connecticut. A clam bake sponsored by the American Plant Food Council was held on the evening of June 27, with more than 200 guests present.

The possibility of holding formal winter meetings was discussed by the Branch, and the president was instructed to appoint a committee to study the problem. Cornell University, Ithaca, N. Y., will be host to the Branch's summer meeting in 1950, it was announced.

•

Lion Continues Expansion

Rapid expansion of the chemical plant of the Lion Oil Company at El Dorado, Ark. is under way, with increased production of anhydrous ammonia and various forms of ammonium nitrate fertilizer as a major objective.

A substantial part of the firm's $7,000,000 building program, launched in 1948, has been centered at the chemical plant, which was erected for War Department use during World War II and was later purchased outright by Lion.

The company has added to the plant further nitric acid facilities for production of ammonium nitrate solutions. The largest single item of the expansion program is the $3,500,000 allocated for increase in the basic ammonia production from the present average of about 430 tons per day to 570 tons per day, an addition of 33 per cent.

Six reaction gas compressors totaling 6,200 horsepower are being added, together with two 1,000-horsepower refrigerating compressors. Also, twelve of the existing compressors are being fitted with improved turboflow conversion parts to increase the output of each compressor from 1,000 to 1,100 horsepower. With total increase in gas-driven compression of 9,400 horsepower, the finished installation will represent 68,000 horsepower under one roof, or what is

believed to be one of the largest concentrations of gas-driven power in the country.

Along with the compressors, a column is being added for carbon dioxide removal, using mono ethanol amine as the absorbent. Also a complete additional unit is being installed for carbon monoxide removal, using a copper solution. One complete new high pressure reactor is being set up, together with the required circulatory system and refrigeration. Utilities are being increased accordingly, including substantial additions to the cooling towers. Anhydrous ammonia storage is being augmented by addition of two 1,300-ton capacity spheres. This plant enlargement has been designed by the Chemical Construction Company of New York.

Completion of the project is scheduled for August, 1949.

Another $2,000,000 is being spent on the chemical plant site for the construction of a $1,250,000 sulfuric acid plant and a $750,000 ammonium sulfate plant.

The sulfuric acid plant will be of the "contact" type and when completed will burn daily approximately 100 tons of Texas bright sulfur to produce 300 tons of sulfuric acid. A vanadium catalyst will be used in the process. The equipment will consist of a furnace, reactor towers, air blowers, acid pumps, storage tanks, a pit for melting sulfur and storage facilities for the sulfur and for 2,000 tons of sulfuric acid.

The ammonium sulfate plant will neutralize 100 tons per day of ammonia with sulfuric acid to produce 380 tons per day of ammonia sulfate. Utilized in the process will be crystallizers, centrifuges, driers and conveyors. Bulk storage is being provided for 4,000 tons of crystal ammonium sulfate.

Both plants were designed by Chemical Construction Corp., which is constructing the sulfuric acid plant. Blaw-Knox Co. is in charge of construction of the ammonium sulfate plant.

■

Work Starts on Ark. Plant

Construction is under way on a new $350,000 farmer-owned fertilizer plant at North Little Rock, Arkansas. Ground was broken on June 16, with appropriate ceremonies, for construction of the main building, dimensions of which are 155 x 300 feet, 55 feet high, consisting of three operating floors. Construction is of steel and concrete. It is being built by the Arkansas Farm Bureau Federation and the Arkansas Farmers Association. About $414,000 in stock was subscribed by farmer members of the two sponsoring organizations to finance construction. Capacity of the plant upon completion, is expected to be 30,000 tons of mixed fertilizer annually. Each share of stock entitles its owner to one ton of fertilizer.

Production is due to begin in the fall of 1949, possibly as early as October.

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2,4-Dichlorophenoxyacetic Acid
Sodium Salt
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Fertilizer Investigation is Proposed by Senate Group

"Monopolistic practices" of the fertilizer industry were targets of an investigation proposed in the Senate on July 20, by a bi-partisan group of senators headed by Glen H. Taylor, Idaho. The investigation would delve into the "nature and extent of monopolistic practices in the fertilizer industry, including the manufacture and distribution of potash, phosphate and nitrogen, the need for development of low-cost fertilizer supplies and for authorization of the construction of fertilizer plants by the proposed Columbia Valley Authority."

The group pointed out that the Tennessee Valley Authority "has demonstrated that highly concentrated fertilizers can greatly decrease the cost of fertilizers to farmers," and charged that "the production of plant food elements, and their mixing and distribution, is controlled by a trust which maintains high prices and enforces uneconomic mixing and dilution of fertilizers."

Other statements appearing in the preamble of the resolution included complaints that the potash industry "has enjoyed extraordinary profits," and that "a few companies control between 80 and 90 percent of the total potash produced in this country". By their restricting production, a "genuine shortage" of cheap potash for fertilizer has been caused, the preamble said.

Other senators backing the proposed investigation, in addition to Sen. Taylor, are: Guy M. Gillette of Iowa, James E. Murray of Montana, Olin D. Johnston of S. Carolina; Garrett L. Withers of Kentucky; John J. Sparkman of Alabama; William Langer of N. Dakota and Warren G. Magnuson of Washington State.

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Armour Markets Sticker

Armour & Co., Chicago, have announced production of "Armour Sticker," an adhesive agent for use with insecticides and fungicides. The product is a formulation containing animal proteins, and is marketed in powdered form. The material is said to be compatible with all commonly-used insecticides and fungicides, and is easy to mix with spray materials.

•

Bemis Offers New Bag

Bemis Bro. Bag Co., St. Louis, Mo., has announced the manufacture of polyethylene lined paper bags for products requiring complete protection from moisture. These bags are available with either one, two or three outer walls of kraft paper and with the liner either loosely inserted or sewn into the bottom seam of the kraft walls.

•

New Plant in Texas

The Pecos Valley Fertilizer and Chemical Co., manufacturers of fertilizers and insecticides has been established recently at Pecos, Texas.

Aero Dusters Organize

Michigan Insecticide and Fungicide Institute is cooperating with the Michigan Department of Aeronautics in making plans for an organizational meeting of Aero Applicators to be held in conjunction with the annual meeting of the Michigan Flying Farmers Association. The meeting was scheduled to be held August 11 at the Capitol City Airport, Lansing, Mich. The advance program called for an aero dusting and spraying demonstration for the afternoon, in addition to the organizational session.

Michigan Insecticide Fungicide Institute has also announced that its annual summer tour would begin August 18 and continue for two days. Departing from the Michigan State College campus, East Lansing, the group's itinerary was to include visits to M.S.C. muck plots, the Dow Experimental Laboratories at South Haven, Mich., and the John Handy farm south of Sodus, Mich.

•

Canadian Weed Meeting Planned

The third Western Canada Weed Conference will be held in Edmonton, Alberta, Canada, on November 15, 16 and 17, according to G. R. Sterling, Supervisor, Soil Conservation and Weed Control, of the Alberta Department of Agriculture, Edmonton.

Names of speakers had not been announced at press time, but a full program is expected to be available for early publication.

•

Opens Consulting Laboratory

S. B. Soloway, formerly research chemist for Julius Hyman & Co., Denver, Colo., and the Bureau of Entomology and Plant Quarantine, Beltsville, Md., has announced that he has established consulting laboratories at 476 Milford St., Brooklyn, N. Y.

•

New Warehouses for Velsicol

Velsicol Corporation, Chicago, has announced that in addition to the recent establishment of warehouse facilities at Columbia, S. C., the firm has supplemented this service by having stock points in Jersey City, N. J.; Portland, Ore.; San Francisco and Los Angeles, California; and in Winnipeg, Man., Canada. David W. Lynch, manager of the Velsicol Insecticide Division, made the announcement.

•

Monsanto Appoints Shorey

Monsanto Chemical Co., St. Louis, Mo., has announced the appointment of Seth Shorey, Kirkwood, Mo., as sales manager for Organic and Phosphate Division products for the Merrimac Division of the company. Mr. Shorey succeeds T. C. Jesdale of Winchester, who was recently promoted to the position of general sales manager. Mr. Shorey will supervise sales of these products in the New England States.

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N. Central Phytopaths Meet

The North Central Division of the American Phytopathological Society held its summer meeting at the University of Nebraska, Lincoln, June 27–28, with a registration of approximately 75 from the north central area.

Dr. Ralph M. Caldwell, Purdue University, was elected president; and Dr. L. E. Melchers, Kansas State College, vice-president. M. F. Kernkamp is secretary-treasurer.

The session opened Monday morning with an address of welcome by Dr. Lambert, Dean of the University College of Agriculture, and a brief address by Dr. Goss, Dean of the University of Nebraska Graduate School. Dean Goss outlined briefly the agriculture of Nebraska and pointed out specifically the major phytopathological problems of the state.

A tour of laboratories and greenhouses was taken on Monday afternoon with members of the plant pathology staff and graduate students as tour leaders. The group inspected various research projects now under way.

The annual banquet was held Monday night at the Cornhusker Hotel in Lincoln, and the sessions continued on Tuesday morning with another tour which took the group to a number of field plots where experiments were being conducted on potatoes, tomatoes, cereals, and alfalfa diseases.

Tuesday afternoon's session, the final one of the meeting, was under the chairmanship of the retiring president, Dr. H. C. Young, Department of Botany and Plant Pathology, Ohio Agricultural Experiment Station, Wooster.

•

450 Attend S. C. Meeting

A total of 450 fertilizer and insecticide manufacturers, dealers and salesmen met at the Edisto Experiment Station, a branch of Clemson Agricultural College, Blackville, S. C. on July 28, for an all-day tour and demonstration of the latest types of agricultural dusting and spraying equipment.

Large-scale cotton mechanization and boll weevil control work and a number of fertilizer experiments were on the agenda for the tour. Machines for applying anhydrous ammonia, cotton choppers, and the latest types of spraying and dusting machines were demonstrated.

In charge of the day's activities were W. B. Rogers, superintendent of the Edisto Station; Dr. B. D. Cloaninger, head of the Department of Fertilizer Inspection and Analysis, Clemson College; Dr. R. F. Poole, president of Clemson College and Dr. H. P. Cooper, Director of South Carolina Agricultural Experiment Station.

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Wisconsin Symposia Scheduled

Two symposia on mineral nutrition of plants and plant growth substances are planned to be held at the University of Wisconsin, Madison, next month in connection with the school's centennial celebration. The first symposium, beginning on September 1, will discuss mineral nutrition. The second, to start on September 5, takes up the subject of plant growth substances.

Speakers named on the advance program include W. Noble Clark, Director of the U. of Wisconsin Agricultural Experiment Station; Dr. E. B. Fred, president of the University; Dr. Emil Truog, Wisconsin U.; C. E. Marshall, U. of Missouri; Lyman A. Dean U. S. Department of Agriculture, Beltsville, Md.; and Roy Overstreet, U.S.D.A., University of California.

"Transportation of Water and Mineral Nutrients" will be discussed by Hans Burstrom, University of Lund, Sweden. Damon Boynton, Cornell U. and Jackson Hester, Campbell Soup Co., are scheduled to talk on field problems in plant nutrition. Dr. H. C. Hoagland, Hans Jenny and T. C. Broyer, University of California, are also expected to appear on the program.

Chairmen of the various sections are to include W. Noble Clark, F. W. Parker, U. S. Department of Agriculture; Dr. Firmen E. Bear, Rutgers University; Dr. F. Skoog, University of Wisconsin; and Dr. Russell Coleman, president, National Fertilizer Association, Washington, D. C.

The session of September 5 will be under the chairmanship of Dean C. A. Elvehjem, University of Wisconsin. This symposium is on plant growth substances. Speakers are to include A. J. Haagen-Smit and James Bonner, California Institute of Technology; Thomas Kerr, U.S.D.A., Beltsville, Md.; and F. W. Zimmerman, Boyce Thompson Institute, Yonkers, N. Y.

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Sugar Cane and Nitrogen

Results from fertilizer experiments with sugar cane involving fertilization at two levels of nitrogen have been announced in *Better Crops With Plant Food*, in the issue of June-July, 1949. The experiments, conducted by V. E. Green, D. S. Byrnside and M. B. Sturgis, Agricultural Experiment Station, Baton Rouge, La., were made at two nitrogen levels: 40 pounds per acre and 60 pounds per acre.

Data from these tests indicate that in most cases, 40 pounds per acre of nitrogen can be applied profitably to plant cane. The data also show that 60 to 80 pounds of nitrogen per acre, 25 to 40 pounds of P_2O_5, and 40 to 60 pounds of K_2O applied to stubble cane have definitely given good results under conditions of normal soil moisture and good weed control and on soils of intermediate texture such as very fine sandy loams, silt loams, and silty clay loams.

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WEED CONTROL

continued from page 39

such grasses as quack grass (*Agropyron repens L.*) and Kentucky blue grass (*Poa pratensis L.*) become established in the older bed. It is the general opinion that these grasses interfere with spraying and harvesting operations.

Field applications of "TCA" (3) made in the fall of 1947 and in the spring and summer of 1948 indicate that these grasses can be controlled satisfactorily without injury to the raspberry plants if applied at the proper time. Applications were made November 10, 1947, and April 28 and July 6, 1948, at the rate of 10, 30 and 60 pounds per acre. It was observed that the fall application controlled the grasses satisfactorily with the least amount of injury to the raspberry plants. The 10-pound application, although reducing the stand, did not control the grasses. Thirty pounds per acre gave better control, whereas 60 pounds eliminated these grasses from the row.

The April application at the same rates per acre compared favorably with the fall applications as far as grass control was concerned but some chlorosis of raspberry foliage was observed during the summer. The buds of the raspberry plants were breaking at the time of the application, whereas they were dormant when the fall application was made. Considerable foliage injury resulted from the summer applications although the grasses were controlled at the higher rates.

No appreciable difference in cane length was observed among the various treatments (Table 1). It was noticed that Kentucky blue grass was more resistant to TCA than was quack grass. The fall application proved to be more successful than the spring and summer applications. This probably was due to the fact that the raspberry canes were dormant and the grasses were still green when the material was applied.

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Control of Rootworm

Losses of field-cured peanuts caused by the southern corn rootworm (*Diabratica undecimpunctata howardi* Barber) on heavy, poorly drained land ran as high as 80 percent of the total yield as determined by counts of injured pods. These losses became progressively greater in the Virginia-North Carolina commercial peanut-growing area during the year 1945–1948 than in previous years.

During 1948 significant control was obtained at Holland, Va., with certain organic insecticides broadcast as dusts by hand over the soil of small plots and raked into the upper 1–2 inches. These materials and the dosages per acre were as follows: Technical benzene hexachloride at 1 or 1.5 pounds of the gamma isomer; 5 pounds of parathion, 40 pounds of toxaphene, and 67 pounds of DDT. Applications made on June 3 were more effective than those on July 7–8.

Three applications to peanut foliage of emulsions containing technical benzene hexachloride or chlordane, at the rate of approximately 0.38 pound of the active ingredient per acre-application, gave significant control at Beltsville, Md., where the infestation was less severe than in southeastern Virginia. At Beltsville, dust mixtures containing technical benzene hexachloride or toxaphene applied at approximately 0.23 and 2.3 pounds of active ingredient per acre-application, respectively, also gave excellent control.

Seven applications of certain formulations were made to the foliage on small plots of peanuts at Holland, Va., during the period June 19 to August 23, in order to obtain maximum control. The following formulations gave significant control: In dust form, 1 and 2 percent of the gamma isomer of technical benzene hexachloride, 2 percent of parathion, 5 and 10 percent of chlordane, and 10 and 20 percent of toxaphene; in emulsion form, 0.5 percent of the gamma isomer of benzene hexachloride and 0.5 and 1 percent of chlordane. Benzene hexachloride gave significantly better control than any of the other insecticides. — W. D. Fronk, Virginia Ag. Exp. Station, and T. N. Robbins, U.S.D.A. Div. of Cereal and Forage Insect Investigations. U.S.D.A. bulletin E-782.

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Thomas Ware Advanced

Thomas M. Ware has been appointed chief engineer of International Minerals & Chemical Corp., Chicago. His appointment became effective July 1. Mr. Ware succeeds James H. Barr, who has retired after 38 years of service for the corporation. Mr. Barr will be retained in a limited consulting capacity for an indefinite period.

Mr. Ware is a graduate of Cornell University, with a degree in mechanical engineering. Before the war, he was an armament engineer with the aircraft industry, and during the war was with the U. S. Navy, Office of Naval Research, Special Devices Division. He was with George Fry & Associates, management consulting engineers before joining International.

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Pyrethrum Magazine Out

Pyrethrum Post, official publication of the Pyrethrum Research Council, London, carries in its April issue (received in New York July 15) an article on Pyrethrum and Grain Storage, with illustrations and diagrams showing the correct procedure and use. Another feature concludes a discussion on the chemistry of the insecticidal constituents of pyrethrum flowers, by S. H. Harper, Kings College, London, and a story of synthesizing pyrethrins in the U. S.

ARIZONA MEETING

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ing TEPP and parathion were given showing their relative inhibiting symptoms.

Para-oxon, the oxygen analog of parathion, was compared with parathion. Their effects were traced directly to the physiology of the insect, and the presence of cholinesterase. Parathion and TEPP may have actions in the body other than inhibiting cholinesterase. The object of a study of this kind is to be able to choose products less toxic to mammals and more toxic to insects.

"Field Studies with Some New Acaricides for Control of Citrus Red Mite" by L. R. Jeppson, University of California, Riverside, were carried on with the following materials applied for the control of citrus red mite: "Arathane" (Rohm & Haas); "K-6451" (Dow); "88R," "83N," and "N57" (Naugatuck Chemical Div); "EPN" (DuPont) "923" (General Chemical Co.); "C-497" (Julius Hyman & Co.); "645A" (Commercial Solvents Corp.); "ASP-47" (Victor Chemical Works); and "Miticide No. 2" (Carbide and Carbon Div.). They were applied in different types of equipment. Some were applied as dusts and some as sprays. While some were most effective against adults others were effective only against eggs. From these tests it seems possible to work out combinations that should be effective against both adult and egg, he declared.

J. H. Freitag, Associate Entomologist, University of California, Berkeley, presented an invitational paper entitled, "A Comparison of Aphids and Beetles as Vectors of Cucurbit Viruses." Two cucurbit viruses were under consideration: 1. The squash mosaic virus, (widely distributed in California) and 2. Western cucumber mosaic virus. The latter is transmitted only by aphids. It has not been isolated.

Insects as virus vectors fall into two classes: Persistent and non-persistent types. In the former, the insect retains the virus for life but the virus is latent and cannot be transmitted immediately. In the non-persistent type, the insect can infect immediately or very soon, and the virus is lost by the insect in an hour or two.

Does the virus overwinter in the insects? Mr. Freitag asked. Insects collected in February were brought into the laboratory and infected cucumbers, he reported. Since *Diabrotica* which includes the western striped cucumber beetle and the western spotted cucumber beetle are not known to have salivary glands, it a question whether the virus gets into the plants by regurgitation, considered probable, or through feces. Active virus has been recovered from the blood of *Diabrotica*, he said.

The paper entitled, "Cantaloupe Mosaic Vectors in the Imperial Valley" by R. C. Dickson, R. A. Flock, and M. Johnson, University of California, Riverside, nicely followed Mr. Freitag's presentation. The important vectors of this serious disease are aphids, chiefly the green peach aphid which breeds on sugar beets, lettuce and various weeds, the paper stated. There are about 38 species of aphids in Imperial Valley. About 7% of the infestation is western cucumber mosaic virus and 93% squash mosaic virus or a closely related one.

G. F. Knowlton, Professor of Entomology, Utah State Agricultural College, Logan, presented an invitational paper entitled, "The Effect of New Insecticides on Bees and Pollination Factors." During the last thirty years the worst poisoning of bees to occur in Utah was from arsenic. The worker bees would carry back contaminated pollen to the hive where a chain of poisoning continued. But the situation is not hopeless. If the workers are killed by the newer insecticides, there is still a strong colony to put out new workers to pollenize the next crop.

Pollen preferences enter into consideration, Prof. Knowlton said. It is possible to set a good crop of alfalfa if the insecticide treatment is put on only ahead of bloom. If the alfalfa field is unattractive during bloom, then pollination is low for the bees go to poverty weed, and yellow and white clover.

The paper by H. T. Gordon, University of California, Berkeley, entitled "Evolution of Uric Acid Metabolism in Insects" was presented by Dr. Hoskins.

Another, entitled "A Synthesis of Radioactive DDT with C^{14}" by F. A. Gunther, J. H. Barkley, R. C. Blinn, and M. I. Elliot, University of California, Riverside, was read by R. B. March. "Although we have not actually prepared radio DDT itself, we have evolved a five-step synthesis from carbon dioxide to 2,2-bis-(p-chlorophenyl)-1,1,1-trichloroethane with the radio-carbon inserted at the 2-position. When based upon barium carbonate, the overall yield of p,p'-DDT is only 14 per cent, but the synthesis is presented at this time for scrutiny by other workers for improvements and for possible application to suitable problems," he said.

•

Bulk Fertilizer Tests

Consumers Cooperative Association, with headquarters at Kansas City, Mo., last month conducted a series of field demonstrations of the rapid application of fertilizer from specially constructed trucks. Bulk material transported by rail from

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the new CCA fertilizer plant at St. Joseph, Mo., was unloaded from the cars onto trucks equipped with a drag feed and a 16½ foot augur spreader and then driven direct to the fields for spreading. The test was made in five different communities.

EXP. STATIONS

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Rawlins and A. C. Davis, Ithaca, reviews the records of early attempts to control the pest, and brings the reader up to date on later methods.

Use of benzene hexachloride, thoroughly mixed with the soil at the rate of 1 pound of the gamma isomer per acre, will control wireworms, the article says. The insecticide is intimately mixed with the top 3 to 4 inches of top soil. Chlordane and compound "118" are effective at the rate of 4 to 8 pounds per acre, while "heptachlor" shows promise at 2 to 4 pounds per acre.

The writers emphasize the preparation of the soil before application. The land must be plowed and disced or harrowed at least once before treatment; and afterwards, the field is fitted by harrow at least twice to insure complete mixing. The field is then ready for planting.

Warnings are issued, however, on the possible altering of flavor and odor of potatoes by the use of insecticides. As has been noted in other tests, potatoes from plots treated with BHC had a "strong, objectionable off-odor and off-flavor." The flavor of potatoes from plots treated with chlordane or with heptachlor was slightly different from that of potatoes from untreated plots, but this difference was not regarded as "objectionable".

The authors conclude that "while progress is being made in wireworm control with soil insecticides, the hazards of widespread usage are too great for unqualified recommendations. Growers are urged not to use benzene hexachloride, chlordane or the other new compounds on large areas of their farms."

LISTENING POST

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dance of hold-over blighted twigs. Spore development was uniformly high in all averages ranging from 10 to 16 sporodochia per blighted twig. Consequently, it is reasonable to assume that except for the presence of the eradicant spray, conditions were favorable for abundant sporodochial development in the test orchards that received it as well as the control orchards that did not.

Frequent rains throughout the blossoming stage of the apricot trees gave several periods favorable to blossom infection by the fungus, and interrupted the application of protective sprays. Consequently, variations in the incidence of blossom blighting between orchards, or different parts of the same orchard, seem likely because of differences in the timing of the protective sprays during this critical period. To determine the variability of blossom infection among trees sprayed with bordeaux only, therefore, eight orchards (including the four used as controls) in the vicinity of the test orchards were examined for the disease. The trees in these eight orchards bore numerous hold-over blighted twigs. All the orchards were sprayed with bordeaux 10–10–100 at some time during the period from March 4 to March 15. The following percentages of blighted blossoming twigs were found: 8, 14, 15, 17, 19, 27, 31, 35, (average 21 percent). The third control orchard (with 15 percent infection) and test orchard No. 1 were adjacent and received bordeaux on the same days. For comparing the incidence of infection in orchards receiving bordeaux only with that in orchards receiving both monocalcium arsenite and bordeaux, therefore, an average of 21 percent for the former did not seem unreasonably high. The following data on control of the disease were computed from this average.

It may be seen that the arsenite spray reduced sporodochial development by 58 to 91 percent, and twig infection by 75 to 99 percent, regardless of the other materials added. The lowest reduction both in sporodochial development and in incidence of the disease occurred in test orchard No. 2. Here both the eradicant spray and the protective spray were applied with mechanically operated spray nozzles. Here, also, occurred the greatest variability in the sporodochial numbers from one part of the trees to another. Sporodochia were much more numerous on twigs from peripheral branches than on twigs from central branches. Apparently, therefore, incomplete coverage of the twigs by the eradicant spray occurred. Sporodochial numbers in test orchards 1 and 3, on the other hand, varied little from one part of the tree to another. These orchards were sprayed by hand-operated nozzles.

These results indicate that addition of bordeaux 4–4–100 and ½ percent petroleum oil did not affect the eradicant action of a 3–100 monocalcium arsenite preparation on spore production of this brown-rot fungus significantly.

BHC TESTS

continued from page 35

varied to meet local conditions in the best way. However, the individuals who cooperated in rating the samples were considered to be sufficiently representative to provide a reasonably satisfactory appraisal.

Results

DELTA was the only isomer that caused injury to plants when applied to the portions above the ground. Delta and beta isomers applied to portions above ground or mixed in the soil imparted a foreign odor or flavor to the edible portion of treated crops more often than alpha and gamma, and the

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odor or flavor was stronger. Heavy dosages of each isomer applied to portions above ground or mixed in the soil affected odor and flavor of some crops, but in general, the effect of the alpha and gamma isomers were much less marked than that of the other isomers.

Conclusions

WHILE these studies are admittedly only preliminary, they do indicate that most of the off-flavor caused in products by benzene hexachloride may result from the presence of the isomers other than gamma. They indicate, particularly, that benzene hexachloride formulations should contain the minimum practical quantity of the delta isomer when they are to be used in situations where plant safety may be involved and the minimum practical quantity of both the beta and delta isomers when the flavor or odor of the edible portion of plants may be affected. They also indicated that it would be helpful to eliminate the major portion of the alpha isomer. This suggests that, where the use of insecticides containing benzene hexachloride may cause off-flavor of the current or future season's crops, future research work should be based on formulations prepared from the relatively pure gamma isomer. Benzene hexachloride has proven to be very effective in the control of various insect pests. The results reported indicate that this chemical should not be arbitrarily ruled out because of the fear of flavor or odor contamination of crops until thorough tests have been completed with formulations of essentially pure gamma isomer.

It is urged that all experimenting with benzene hexachloride report the results in a way that will clearly describe the composition of the material tested.

BEE MORTALITY

Continued from page 29

Since in this experiment insecticides were applied during hours when bees were not visiting the field, the results probably represent the minimum mortality to be expected. When DDT was applied during hours while bees were on the field, much higher mortality was observed. The same principle would probably be true with chlordane, parathion, or toxaphene.

Agriculture has need of insecticides negligibly toxic to bees. The tolerance of honey bees to toxaphene exhibited in these tests appears to be of practical importance. For example, this compound will meet the need for emergency treatment during the flowering period for control of *Lygus* and alfalfa weevil in seed alfalfa. Toxaphene is also currently recommended for control of grasshoppers (Parker and Wakeland 1948). It is sometimes advantageous to control grasshoppers on crops after flowers have appeared. Further tests are necessary before we may conclude whether this insecticide can be used with reasonable safety to bees on flowering crops. Future tests on alfalfa should be made on a larger scale and in an area where bees collect pollen as well as nectar from the treated crop.

Summary

AN experiment was performed to test the effect on honey bees of dusting in-flower alfalfa with 3 per cent DDT, 5 per cent chlordane, 1 per cent parathion, and 10 per cent toxaphene. All insecticides were applied with a power duster during hours when no bee visitors were on the field. The time interval between dustings was sufficient to permit the bee activity to return to normal.

The field bees were the affected part of the colony and most of the mortality occurred within two days after applications. Parathion killed about 40 per cent of the visitors, DDT 28 per cent, and chlordane 23 per cent. The mortalities in two tests with toxaphene were 8 and 2 per cent.

Depression of the number of visitors to the field was noted with DDT, chlordane, and parathion. However, mortality largely accounted for the depression in tests made with chlordane and parathion. DDT showed a slow repellency, which tended to limit the total number of deaths by reducing the number of collectors working on the field.

In the tests with parathion two-thirds of the bees died in the apiary, whereas two-thirds of the deaths from chlordane and most of the mortality from DDT and from toxaphene occurred in the field.

The results indicate that dusting of flowering alfalfa during a honey flow may reduce markedly the honey yield when applied to a considerable proportion of the bee range. The low mortality of bees caused by toxaphene in this experiment, if maintained in tests under other conditions and on a large scale, indicates a wider use for this material in insect-control programs.

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Mul-si-mo is a thin amber-colored oily liquid about the same viscosity as Kerosene Oil.

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There is nothing complicated about the use of *Mul-si-mo*. It is just poured into the oil to be treated at the rate of ½ to 1%, depending upon the tightness of emulsion desired, then thoroughly stirred and the process is completed.

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A practically 100% Oil Product—No Water—No Soap—No Potash nor other Alkalines.

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Mul-si-mo is Neutral, Mul-si-mo-Made Emulsions are not adversely affected by pronounced saline, alkaline or acid re-acting waters.

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Mul-si-mo, we believe, is the cheapest and most economical Emulsifier on the market for the emulsification of the oils above specified.

NON-TOXIC TO PLANTS
Extensive tests have shown *Mul-si-mo* to be non-toxic to plants when used at a dilution of 1 to 100. (Plants used in tests —Coleus.) As summer oils are usually used at the dilution of half-gal. to 100 gals. water, at such dilution the rate of *Mul-si-mo* to water would be 1 to 20,000.

COST OF MUL-SI-MO
Per Gallon $4.00; 5 Gallons and up @ $3.75 per Gallon; 50 Gallon Drums @ $3.50 per Gallon, f.o.b. New York or Jersey City. (Above prices for U. S. only. Foreign prices on request.)

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Industry Patents

2,473,833. SPRAYER NOZZLE. Patent issued June 21, 1949, to Joseph Zielinski, Brooklyn, New York. A nozzle comprising a hollow body having a converging top and bottom, ends secured thereto, and a rear member attached to the top and bottom and ends, the top and bottom converging and being separated along one edge to present a narrow elongated opening, a valve element having a tapered edge in said opening of substantially the same length as said opening, a bar to which the valve element is affixed, said bar having rounded sides presented to the converging top and bottom and converging towards said valve element, means comprising a rod rotatably attached to the bar and projecting through the rear member to the outside of the body, a collar on said rod in the body, a spring between the collar and the rear member, the outer end of said rod being threaded, a knob screwed upon said threaded end and a screw plug in the knob for releasably securing the knob to the rod.

2,474,332. SPRAY NOZZLE. Patent issued June 28, 1949, to Carl C. Sciuto, St. Louis, Mo. In a spray nozzle, the combination with a hollow stem having a valve plug at one end and a recess in the periphery thereof, of a revoluble barrel enclosing said stem having interfitting threaded engagement therewith, whereby upon rotation of said barrel relative longitudinal movement in respect to said sleeve is imparted thereto, a wall at one end of said barrel forming an outlet orifice and providing a valve seat for said valve plug, a packing member carried by said barrel at the opposite end to said outlet orifice, said packing including a metal washer on its forward face, and a compressible split ring mounted in said recess in said stem having a frusto-conical surface, the greatest diameter of which faces said washer to permit movement of said barrel in one direction for the assembly of the stem and barrel, and limiting movement in the opposite direction after said members are assembled, the greatest diameter of said split ring being disposed opposite to said metal washer when said stem and barrel are in assembled relation.

TRADE MARK APPLICATIONS

TICKNIX, in script letters, for tick repellent lotion for horses and dogs. Filed June 17, 1948, by Innoventions, Inc., Paoli, Pa. Claims use since April 9, 1948.

GREEN LIGHT, with motif of traffic signal, for insecticides. Filed Sept. 21, 1948, by Klauss-White, San Antonio, Texas. Claims use since Jan. 16, 1948.

MCGRAW'S POLK EASY, in sans serif capital letters, for insecticides. Filed June 14, 1948, by C. L. McGraw, Kathlee, Fla. Claims use since 1926.

VERMI-TOX, in hand-lettered capitals and small capitals, for insecticide in liquid form. Filed June 29, 1948, by the De Pree Co., Holland, Mich. Claims use since Aug. 28, 1922.

OCTOFEN, in hand-lettered script, for fungicide. Filed Oct. 27, 1948, by McKesson & Robbins, Inc., New York. Claims use since September, 1947.

JARECKI'S, in hand-lettered style with drawing of fish as background, for fertilizers. Filed July 12, 1947, by Armour & Co., Chicago, Ill. Claims use since 1929.

FLORIDA TRIPLE PHOSPHATE, with words on each side of a triangle, for fertilizers. Filed Dec. 10, 1947 by Tennessee Corporation, New York. Claims use since August, 1925.

CYAN-CHLOR, in tall letters within shield, for chemical-containing briquettes for generating a toxic gas to destroy rats, mice, flies, roaches, bed bugs, fleas, moths, buffalo bugs and beetles. Filed Aug. 4, 1948, by Safety Fumigant Co., Boston. Claims use since June 4, 1948.

Negley Appoints Brooklyn Firm

Negley Bag & Paper Co., San Antonio, Texas, has announced the appointment of Christ Paper Products Corp., as their sales representatives in the northeast area. The latter company is located in Brooklyn, N. Y.

Negley's manufacturing plant is in West Monroe, La. The company's products include multi-wall bags, and heavy-duty bags.

•

Stephens to Quaker Oats

Noman C. Stephens, formerly with Union Oil Company of Oleum, California, has joined the chemicals department of the Quaker Oats Company, Chicago. He will handle technical sales of the furfural chemicals produced by Quaker Oats.

•

Penick Advances Two

James G. Flanagan has been elected a vice president and Kenneth A. Lawder elected treasurer of S. B. Penick & Company, it was announced recently by S. B. Penick, Jr., President.

Mr. Flanagan is also General Counsel and a Director of the company and has been Secretary since 1942. He joined the firm in 1938.

Mr. Lawder joined S. B. Penick & Company in September 1948. Previously, he was with American & Foreign Power Company, Inc. and affiliated companies, holding the positions of comptroller, secretary and treasurer, and later vice president and director of various of its subsidiaries.

•

Ohio Plant Under Way

The new $150,000 fertilizer plant being built by the Ohio Farmers Grain and Supply association near Fostoria, O., is nearing completion. The plant is expected to be in operation by September 1, according to Earl Neuman, manager. The dimensions of the new plant will be 100 × 200 feet.

•

International Group Meets

The Second International Congress of Crop Protection was to begin in South Kensington, London, England on July 20 and continue through the 29th. The Congress is divided into five sections, which brings together scientists from all parts of the world to exchange information on insecticides, fungicides and weed killers.

Dr. James G. Horsfall, director of the Connecticut Agricultural Experiment Station, New Haven, as honorary president of one of the sections, is the only American to serve in this capacity at the meeting. His section, on equipment and methods of application of agricultural chemicals, will hear him talk on "Chemotherapy for Controlling Plant Diseases".

At least two other Americans were to attend the conference. They are Dr. William E. Rader, Shell Agricultural Chemical Laboratories, Modesto, California; and Dr. Cecil Yarwood, plant pathologist, University of California, Berkeley.

The previous International Congress of Crop Protection was held in Belgium in 1946. Plans are expected to be made for a subsequent gathering, perhaps in the United States.

Classified Advertising

POSITIONS OPEN

Sales Manager: Established midwest manufacturer of insecticides, fungicides, weed killers. A real opportunity for an experienced sales manager with knowledge of midwest wholesalers, canners and dealers. State age, experience, compensation desired and present position. Address Box 368 care of Agricultural Chemicals.

Sales Manager: Experienced—for manufacturer of agricultural spray materials—New York Home Office. Address Box 369 care of Agricultural Chemicals.

POSITIONS WANTED

Position Wanted: Graduate of Clemson College, degree in Vocational Ag., experience as county agent and as Ag. Development agent for railroad, seeks position with fertilizer or insecticide firm. Age 30. Address Box 370 care of Agricultural Chemicals.

Chemical Sales: Man with three years sales experience in insecticides, fungicides, herbicides, soil fumigants and allied agricultural chemicals for leading supplier, desires new connection with manufacturer. Technical education and background, B.S. in agriculture. Biological and entomological experience. For further details, communicate with Box 371, care of Agricultural Chemicals.

Technical Sales: New location sought by college graduate with ten years in technical sales, market research and agricultural investigations among growers and other consumers. Some contacts general pest control operations. Position in sales or sales research desired. Eastern location preferred. Address Box 372, care of Agricultural Chemicals.

MISCELLANEOUS

For Sale: Buffalo Turbine Mist Sprayer-Duster Trailer Model used only thirty hours as demonstrator. Perfect condition. Sacrifice $900. F.O.B. Los Angeles. Write: Pest Control Supply Company, 6164 Santa Monica Blvd., Hollywood 38, Calif.

Close Out Sale of Hudson Sprayers and Dusters: 435 Cardinal Sprayer, 3 quart $9.00 dozen—661 Signal Duster, $2.50 dozen—766 Admiral Duster, $9.00 dozen. All prices are F.O.B., New York, N. Y. Address Box 373, care of Agricultural Chemicals.

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N. J. Nurserymen Meet

The New Jersey Association of Nurserymen was to hold its annual summer meeting at Rutgers University, New Brunswick, N. J. on August 3. Speakers were to include Dr. W. H. Martin, dean and director of the College of Agriculture and the Experiment Station at Rutgers; Dr. C. C. Hamilton of the Entomology Department; Dr. Spencer H. Davis, Jr., department of Plant Pathology and Wallace A. Mitcheltree of the Soils Department.

•

Stauffer Personnel Changes

Stauffer Chemical Co. has announced the appointment of Dr. Chester L. Arnold as Director of Research for the company. Dr. Arnold was formerly director of research in the western division, and will continue to maintain headquarters at Richmond, California, for the present.

John F. Crowther, formerly assistant director of research, has been named director of the eastern research division. Mr. Crowther will transfer his offices from New York City to the Process Development Laboratory at Chauncey, N. Y.

•

W. H. Sheffield Dies

William H. Sheffield, Ridgewood, N. J., president and general manager of Innis, Speiden & Co. died of a heart attack on July 26 at his summer home near Allenhurst, N. J. Mr. Sheffield was for many years connected with Sheffield Farms Co. He became a director of Innis, Speiden & Co. in 1912, and in 1926 was made president and general manager. This position he maintained until his death.

•

Phillips Plants Operating

Phillips Chemical Co., Bartlesville, Oklahoma, has announced that nearly all of its production of anhydrous ammonia and ammonium sulfate is now available for commercial sale. Anhydrous ammonia is produced at the firm's plant near Etter, Texas, at the rate of some 230 short tons per day. A second unit was to go into production about the first of August, the company states, and will increase the output of anhydrous ammonia to over 400 tons per day.

Ammonium sulfate operations are well under way at the company's Port Adams plant, on the Houston, Texas, ship channel. Capacity is over 250,000 tons per year.

•

Freeport Earnings Up

Consolidated net income of Freeport Sulphur Company for the three months ended June 30, after all charges including depreciation, depletion and Federal income taxes, amounted to $1,370,903, equivalent to $1.71 per share on the 800,000 shares of common stock outstanding, the company has announced. These earnings compare with net income of $974,130, or $1.22 per share for the second quarter of 1948.

•

Chlordane & BHC Kill Grubs

Reporting on control of Japanese beetle grubs, Ohio Agricultural Experiment Station, Wooster, O., states in the 1948 annual report that "Chlordane, applied to the soil at the rate of 5 lbs. of the technical material per acre, and BHC, applied at the rate of 2½ lbs. of the gamma isomer per acre, were as effective in controlling the grubs as is lead arsenate when applied at the rate of 500 lbs. or DDT at the rate of 25 lbs. per acre."

Aircraft in Agriculture

Use of airplanes in agriculture is steadily increasing and is a most important field of aircraft activity, according to the March issue of *Southern Flight*, which quotes Civil Aeronautics Administration figures, in part, as follows:

Activity	Number of Operations	Number of Aircraft
Dusting	768	1883
Spraying	720	1327
Weed Control	545	863
Spreading Fertilizer	265	768
Crop Defoliation	242	675
Mosquito Control	141	255
Rain Making	55	74
Spraying Ripened Fruit to Stop Dropping	48	136
Plant Pollination	47	115
Anti-frost agitation	26	77
Chasing Birds from Rice Fields	9	18
Agitating Cherry Trees to shake off water after rain	9	17
Rodent Control	2	2

—*Arkansas State Plant News*, May, 1949

•

King Joins Quaker Oats

James R. King, formerly associated with the Argonne National Laboratory in Chicago, has joined the chemicals department of The Quaker Oats Company, Chicago. He will be concerned with market development of the fertilizer ingredient "Fur-Ag", furfural and its derivatives, which the firm produces at plants at Memphis, Tennessee and Cedar Rapids, Iowa plants.

•

New Spray Hose Developed

B. F. Goodrich Co., Akron, O., has announced the development of a spray hose designed to withstand internal pressures up to 800 pounds per square inch. The hose is made in long lengths and is treated to handle sprays which have heretofore been destructive to rubber hose.

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TALE ENDS

ENTOMOLOGISTS tell us that this year's infestation of boll weevil in the cotton-growing states is the biggest in history! Conditions have been almost completely favorable for the huge populations which appeared with devastating suddenness, and with appetites as big as their numbers. Timely application of toxaphane and BHC along with other insecticides, including the old stand-by, calcium arsenate, have succeeded in holding the hordes in check . . . but what a race it has been!

Suppliers of basic chemicals, distributors, wholesalers, retailers and even the buyers have been maintaining a frantic pace for the past couple of months to get the needed materials. Vacations have been cancelled . . . cool-headed business men have assumed the appearance of the hunted . . . and some have confided that if the situation continued much longer, they would individually and collectively be ready for straightjackets.

But next year . . . ahhh! The mistakes of 1949 shall not be repeated, they say. Buy early, is the best advice we know!

* * *

Efforts of a New Jersey soil zealot to import king-sized earthworms into the U. S. from Australia are not expected to succeed, it is reported. The Australian variety of earthworm, largest in the world, reach some ten feet in length and measure about an inch across. These worms, it is said, help to fertilize the soil directly under the surface in a manner proportionate to their size.

Fear that the worms might carry plant disease viruses within their bodies is said to be the main reason why officials declined to allow the creatures to start working in American soil. There might also be a more subtle angle to the idea, and that is the likelihood of a reduction in rural consumption of liquor if farmers should start seeing these unbelieveable creatures crawling around their farms!

imagine!

That's what nitrogen does. It raises crops and yields to new heights. But it takes a lot to ease the earth's growing pains. Fertilizers and cover crops help. So do measures that reduce loss from erosion and leeching. Despite all these efforts, the net annual deficit of nitrogen in the United States is in excess of 6 million tons. The efficient use of ammonia is helping to solve this big problem. There is no richer, more economical source of nitrogen known.

Commercial Solvents Corporation is producing anhydrous ammonia at its Dixie Plant at Sterlington, Louisiana. In production 24 hours a day, Commercial Solvents is supplying the major part of this output to Gulf Coast manufacturers for conversion into nitrogen-rich fertilizers.

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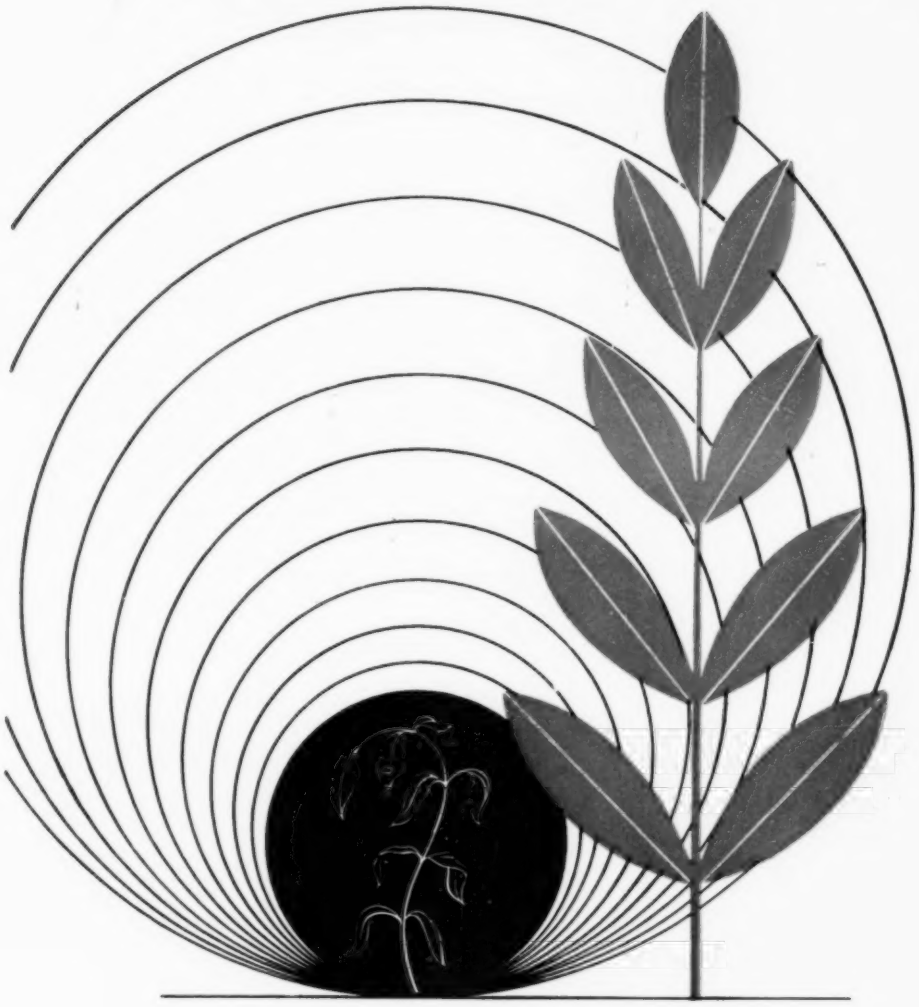

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agricultural insecticides

Toxaphene (chlorinated camphene, 67-69% Cl.) is recommended by leading cotton growing states for control of boll weevils and other cotton insects. It is recommended by USDA for grasshopper control. Are you prepared to meet resulting demands for toxaphene dusts and sprays in these markets and in others as they develop? Write for 16-page book, "Facts About Toxaphene Insecticides."

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